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ABSTRACT

The obsolescence of university research facilities is addressed in this 1985 conference report. Seven of the major topics were potential action items for Congress and federal agencies, including approaches to facilities funding, such as acceleration of indirect cost recovery, provision of credit support, and federal funding of a national facility program. Other items concern the process for decision-making about federally-funded facilities, and changes in tax incentives for private sector support for modernization of academic research facilities. Possible actions for the states and colleges are also identified. Included are an opening statement by National Science Board Chairman Roland Schmitt and statements of working groups on: grants and gifts, alternative funding sources, partnerships, college policies and practices, the state role, and comprehensive merit review for facilities. Background documents are also provided: the text of a bill, "University Research Facilities Revitalization Act of 1985" (H.R. 2823), a paper on tax-exempt financing by David Clapp, a proposal concerning college construction loan insurance, and a paper on explicit rent charges by Robert Sproull. (SW)

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Academic Research Facilities: Financing Strategies

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Academic Research Facilities: Financing Strategies

Report of a Conference July 22-23, 1985

NATIONAL
SCIENCE BOARD

OFFICE OF SCIENCE &
TECHNOLOGY POLICY

GOVERNMENT-UNIVERSITY-
INDUSTRY RESEARCH
ROUNDTABLE

National Academy Press Washington, D.C. 1986

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The Office of Science and Technology Policy is the White House office that serves as a source of scientific and technological analysis and judgment for the President with respect to policies, plans, and programs of the Federal Government. The Director of the Office also serves as the President's Science Advisor with responsibility for, among other things, evaluating the nation's science and technology effort and providing advice on the scientific and technological aspects of national security, economic, health, energy, and environmental matters.

The National Science Board is the governing body of the National Science Foundation. The Board is composed of 24 members appointed by the President for six-year terms, and the Director of the Foundation. Members are selected for their distinguished service in science, engineering, education, industry, research management, public affairs, medicine, and agriculture; they represent all areas of the nation. The principal role of the Board is to establish policies for the Foundation to fulfill its various statutory missions and oversee its operations. The Board also assists in the formulation of national science policies.

The Government-University-Industry Research Roundtable is a forum for scientists, engineers, administrators, and policymakers from all sectors to explore ways of improving the productivity of the nation's research enterprise. The objectives are to understand issues, to inject imaginative thought into the system, and to provide a setting for discussion and the seeking of common ground. The Roundtable develops options and brings all interested parties together; it does not make recommendations nor offer specific advice. The Roundtable is sponsored by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

This report has been prepared in two versions. Additional copies of the Executive Summary and copies of the entire report are available at no charge from:

Government-University-Industry Research Roundtable
National Academy of Sciences (JH 308)
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

PREFACE

America's economic and defense strength depend in large part on the excellence of its academic institutions as sources of trained scientists and engineers and new ideas in science and engineering. That excellence is threatened today by the growing obsolescence of academic facilities and equipment for research and education. National research leaders and administrators are convinced that the problem requires action soon if the United States is to remain a world leader in an age of rapid technological change and intensifying competition. Estimates of the total funds needed to modernize academic science and engineering facilities vary, but all are in the billions. The scale of the equipment problem is comparable.

These problems confront us at a time of financial constraints brought about by recognition of the need to curb budget deficits. So the problems of modernizing academic facilities and equipment cannot be addressed simply by additional dollars. They will also require the reallocation of present funding within the nation's total R&D budget and within its universities and colleges, along with the more efficient use of funds.

Many possible actions to meet these problems emerged from the conference described in this report. No single solution will be sufficient. Many of them, especially those involving reallocation, will be painful. But as conference sponsors, we are convinced that action now is necessary if the nation is to avoid the greater pain that would result from sacrifice of one of our greatest strengths: leadership in science and engineering.

John McTague
Acting Director
Office of Science and
Technology Policy

Roland Schmitt
Chairman
National Science Board

Dale Corson
Dale Corson
Chairman
Government-University-Industry
Research Roundtable

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PART I: EXECUTIVE SUMMARY

Introduction

The need to modernize deteriorating and obsolete research facilities at universities and colleges is of widespread concern to the academic research community and to the government agencies and other organizations which support that community. On July 22-23, 1985, some 200 leading college and university administrators, researchers, industrial and government officials, and representatives of scientific and professional societies gathered at the National Academy of Sciences in Washington, D.C. to discuss the issue. Their principal purpose was to surface and consider a spectrum of approaches that could help address the need at a time of tight constraints on the Federal budget.

The idea for the conference originated in a resolution by the National Science Board, which was joined in sponsoring it by the President's Office of Science and Technology Policy, the National Academies of Science and of Engineering, and the Government-University-Industry Research Roundtable.

Research facilities at our nation's universities and colleges are infrastructure investments with regional and national importance for economic development, industrial competitiveness, national security, and the health and well being of our citizens. But in many research fields, further progress at the leading edge requires new, more productive, and more capital-intensive facilities. Academic institutions and funding agencies have not kept up with facility funding needs for at least the last decade. The problem is exacerbated by the serious fiscal constraints now being faced by Federal agencies; solutions will not be possible through the use of Federal funds alone.

Estimates of the extent of the unmet nationwide need for new construction and renovation vary in the range of $5 to $20 billion in the next 10 to 20 years. No matter what the precise estimate, American research efforts are lagging far behind potential opportunities and are certain to suffer in the future if steps are not taken soon to refurbish existing facilities and build new ones. Accordingly, the conference focussed on developing approaches to the issue rather than attempting once again to estimate its extent.

Efforts by a few academic institutions to obtain facility funding by direct appeal to the Congress are symptomatic of the depth of the facilities modernization problem; such efforts also raise questions about the proper locus and criteria for making decisions about proposed facilities.

Six working groups were organized to consider various aspects of the topic. Each met to discuss draft papers prepared in advance by group leaders and conference staff. The working groups then reported their findings and suggestions to the full conference for further consideration. In addition, a panel discussion was presented concerning the processes used to select facility proposals for Federal funding. The proceedings concluded with statements by representatives of the sponsoring organizations.

The conference was not designed to adopt consensus-based recommendations. The participants were searching for a comprehensive set of approaches that would meet facilities needs on a continuing, long-term basis; recognize the diversity among research institutions and disciplines; and allow for the establishment of new research capabilities as well as the maintenance of existing strengths.

Part I of this report summarizes those approaches and presents them as action items addressed to the Federal Government, to state governments, and to academic institutions. (Although there is no separate section addressed to industry, individual firms and industrial consortia are expected to be essential partners in implementing many of the action items.) The conference agenda and the list of Planning Group members are also included in Part I.

Part II contains the opening statement by Roland Schmitt, reports of working group chairs, statements by convenors and panelists, and a summary of the plenary discussions. Part III contains several key documents referenced in the other parts and the list of conference participants.

The conference was chaired by Dale Corson of the Research Roundtable. It was planned by a group headed by John H. Moore, Deputy Director of the National Science Foundation. Staff support was provided by Don Phillips and Anne Scanley of the Research Roundtable. This report was prepared by Jim McCullough and Pat Dennis of the NSF staff under the direction of John H. Moore.

Actions for the Federal Government

Seven of the major topics discussed at the conference are potential action items for the Congress and Federal agencies. The first three would take differing approaches to facilities funding -- acceleration of indirect cost recovery; provision of credit support through loans, guarantees, and similar mechanisms; and direct Federal funding of a national facility program.

As conference participants pointed out, the facilities modernization issue is only one of several problems affecting the vitality of the nation's scientific and engineering enterprise. Furthermore, current efforts to reduce the Federal budget deficit severely limit the prospect for major new Federal funding initiatives.

F-1: The use allowance for facilities under OMB Circular A-21 should be increased from the present two percent to five percent.

Background: One component of indirect costs chargeable to the Federal Government in R&D grants and contracts with academic institutions is a use allowance for research buildings. The standard allowance is 2 percent per year. Alternatively, institutions may apply a specific depreciation rate if fully documented and agreed to by the auditing authority responsible for the institution (usually the Department of Health and Human Services or the Defense Contract Audit Agency). Interest on certain loans taken by an institution to construct a building may also be included, with the permission of the sponsoring agency.

Applying a more realistic standard use allowance of 5 percent would in effect redefine the useful life of a research facility from 50 years to 20 years. Because indirect cost recovery is linked to specific grants and contracts, facility support provided in this manner depends on the amount of funds an institution receives from competitively awarded proposals.

Comment: Participants viewed the principal advantages of this approach as: (1) linkage of support for particular facilities with individual research projects that, in most cases, have passed the test of peer review; and (2) faster rate of recovery of institutional funds used to maintain facilities and to repay loans used for construction or renovation.

The principal disadvantages discussed were that the payback period remains long, and that this approach would not directly meet the short-term needs of institutions seeking to establish new research capacity or those that currently have a small base of Federal R&D funding. Increased facility cost recovery would come at the expense of other direct and indirect costs (i.e., less research could be supported), unless the total of Federal research funds is raised sufficiently or reallocated within existing national R&D funding. For public institutions there is the additional complexity of varying treatment of recovered costs by state governments.

In the interest of a long-term solution to keep facilities up-to-date, institutions that have not already done so are urged to establish a special capital reserve fund to "capture" and invest the use allowances recovered in this fashion.

In addition, raising the use allowance will better enable institutions to repay loans, as proposed in the next action item.

Note: In December 1985, the White House Science Council's Panel on the Health of U.S. Universities and Colleges released its draft report. One of the Council's recommendations was that the basis for use allowances be reduced to 20 years. The report notes that doing so will "inject reality into the costs of doing research," although it "will increase substantially the indirect fraction of total costs."

F-2: An independent nonprofit corporation should be established to finance academic research facilities.

Background: Of the more than 3,000 institutions of higher education, only about 300 have effective access to the existing tax-exempt bond market. The remainder lack credibility with private lenders, who are not easily able to assess the risks of lending to academic institutions. Most of these institutions are financially viable and capable of servicing moderate debt, but they need a mechanism to provide guarantees of their financial performance to private lenders.

A conference participant (David Clapp of Goldman, Sachs and Company) proposed the creation of an independent, nonprofit corporation to provide low-rate loans, loan guarantees, and other financial assistance for research and educational facilities. The corporation would be established with a one-time, $500 million appropriation; funds could be added from private sources. The corporation would issue its own bonds, using the initial capital as backing, and use the funds obtained to make loans to colleges and universities for construction or renovation. Income from investing the initial capital would be used to defray administrative costs and to subsidize interest costs for the facilities loans. The proposal can be found in Part III of this report.

Comment: Participants viewed as a major advantage the provision of funds prior to construction or renovation. In issuing its own bonds and lending the proceeds to qualifying institutions, the corporation would diversify risk and thus provide the possibility of lower interest rates. The bundling of numerous loans into single debt instrument issues would produce administrative cost savings. Perhaps most importantly, the corporation would afford access to tax-free bond markets to institutions that would not otherwise enjoy such access.

With its own capital base established by initial Federal funding and possibly funds from other sources, the corporation would be a permanent, independent entity. Through the interest payments made by its debtors, it would represent a long-term source of capital for research facilities.

The corporation's evaluation of proposals for facilities loans would necessarily involve review of a business plan as well as review for scientific merit. To the extent that use charges or depreciation are used to pay back loans, this option is coupled with the first approach.

Note: Subsequent to the conference, the House passed a proposal for a facility loan guarantee corporation. Title VII of H.R. 3700, the Higher Education Act Amendments of 1985, as adopted in December 1985, authorizes a private, for-profit entity known as the College Construction Loan Insurance Corporation (CCLIC). It would be organized through the Departments of Education and Treasury and the Student Loan Marketing Association. The CCLIC would issue stock and use the proceeds to guarantee and insure bonds, loans, leases, and other debt instruments for any "educational facilities purpose." Qualified purposes include not only construction or renovation of facilities for education, training, or research but also acquisition of research instrumentation and instructional equipment. The relevant portion of H.R. 3700 can be found in Part III.

The effectiveness of the Student Loan Marketing Association (SLMA) would be an indispensable asset in undertaking the new corporation. SLMA has a remarkable record of generating private investment in support of student aid. Since it was established in 1972 it has attracted private capital in excess of $650 million, and supports some $14 billion in loans to students. In doing so, SLMA has maintained a very strong financial condition, and has the credibility in the private marketplace that is essential to its success.

F-3: The concept embodied in H.R. 2823, a bill to authorize increased Federal support for construction and renovation of academic research facilities, should be supported. Funds should not be provided on a set-aside basis, however, but should supplement existing research funds.

Background: H.R. 2823, the "University Research Facilities Revitalization Act of 1985," was introduced on June 20, 1985, by Representative Don Fuqua (D-FL), Chairman of the House Committee on Science and Technology. The bill would authorize the six agencies that expend 84 percent of Federal research and development funds (NSF, DoD, DoE, HHS, USDA, NASA) to establish programs for modernizing college and university laboratories. A total of $470 million in "start-up funds" would be authorized for the first year (fiscal 1987); in succeeding years through fiscal 1996, the six agencies would be required to spend at least 10 percent of their academic R&D funding for the purposes of the bill. At least 15 percent of the amounts reserved for the program would be allocated to institutions below the top 100 in Federal R&D funding. Any Federal award could not exceed half the cost of the proposed construction or renovation, with remaining funds from institutional or other non-Federal sources.

On introducing the bill and again at the conference, Mr. Fuqua characterized it as a point of departure and a vehicle to develop consensus among the academic community, the Federal agencies and the Congress. The bill and the statement that accompanied its introduction can be found in Part III of this report.

Comment: Enactment of such legislation was supported by many participants who believe that clarification of agency authority to support facility renovation and construction is necessary, and that it would help stem the flow of direct appeals by individual institutions to Congress for specific facility appropriations. The legislation was also seen as an effective means of leveraging additional funds from the states, industry, and academic institutions.

The principal concern of some participants was that a set-aside provision could result in funds being diverted from support for research projects and programs. Some participants, however, felt that such a trade-off would be appropriate.

The set-aside provision was also criticized on the grounds that it could force the Federal agencies to approach facilities support in the same manner, whereas needs vary by discipline, program, and institution. (Note that the bill addresses this concern by permitting the head of each agency to issue regulations prescribing the terms and conditions of its program.)

Many participants felt that the matching requirement is a strong feature of the bill, and they appealed for flexibility in the ways such a requirement could be fulfilled. The concept of funding facilities through block grants to states or regions (not a feature of the bill) was strongly rejected.

The next item in this section concerns the process for making decisions about federally funded facilities:

F-4: A comprehensive review of the criteria used to make facilities funding decisions in the past should be carried out, to provide a firm foundation for recommendations about future facilities decision mechanisms.

Background: One of the working groups addressed the idea of "comprehensive merit review" of facilities proposals, to include considerations beyond those of the traditional peer review -- especially a more explicit recognition of the economic, social, and environmental effects of particular decisions. More information on the proposal may be found in the report of Working Group Six in Part II of this report.

Comment: Conference participants discussed this idea at length but were far from reaching consensus, with substantially differing points of view regarding the feasibility and value of this approach.

Proponents believe that the Federal interest in a national facilities modernization program requires taking factors other than scientific merit into account -- including broadening the base of research institutions and developing research potential throughout the nation. Accommodating explicit social and political factors may require more extensive participation in the review process by nondisciplinary specialists.

Opponents state that the concept of "comprehensive merit review" is dangerously confusing since no boundary conditions are defined; a decision to fund a particular facility at a particular location, therefore, could respond to any number of imprecise considerations, with decision factors that are unweighted and open-ended. This would lead to undisciplined competition, more overt politicization of the university research enterprise, and the risk that any national policy to invest in facilities would collapse.

The difficulties and complexity of this issue were acknowledged by all parties.

The next two items deal with changes in tax incentives for industrial and other private sector support for modernization of academic research facilities.

F-5: Proposals for tax reform should be monitored to evaluate their effects on facilities funding.

Background: The conditions for issuing tax-exempt bonds for facilities construction (and other purposes) are governed by Federal tax law. Many participants were quite concerned that pending amendments could serve to limit or foreclose the use of this means to modernize the research infrastructure.

Comment: Since the conference the House has approved H.R. 3838, the Tax Reform Act of 1985, which includes provisions that would severely limit the issuance of tax-exempt bonds by private educational institutions and which could, depending on the eventual interpretation, have the same effect on state institutions.

F-6: The tax credit now available for research equipment donations should be extended to similar donations for academic research facilities. Generally, thought should be given to new tax inducements for facilities supported by the private sector.

Background: The Economic Recovery Tax Act (ERTA) of 1981 allows research equipment manufacturers that donate equipment to universities to take a tax deduction amounting to the cost of producing the equipment, plus half the difference between production cost and fair market value. Among other conditions, the Act excludes donations for educational equipment (as distinguished from research training equipment) and excludes equipment to be used for social and behavioral research.

Comment: The tax reform legislation mentioned above purposefully did not expand the existing equipment donation provisions to cover educational use, social and behavioral research, or contributions of software. The concept of extending it to cover facilities modernization was not proposed.

The final item addressed to the Federal Government calls for additional information on the nature, size, and scope of the facilities modernization issue:

F-7: A careful study emphasizing the collection of better data on the state of academic research facilities should be undertaken.

Background: As mentioned in the introduction, estimates of the precise magnitude and extent of facilities modernization needs vary due to differences in definitions, sampling techniques, and time periods used. The conferees saw a need for a continuing, authoritative source of data collection and analysis of this issue.

Since the conference, the Congress has directed the Foundation to develop systematic information on facilities needs and report the results. The pilot survey is being conducted under the auspices of NSF's Science Resources Studies (SRS) Division, and a report will be forwarded in September 1986. SRS intends to conduct such surveys on a biennial basis.

Actions for State Governments

Research facilities contribute to a state government's objectives as well as national needs; thus, direct and indirect state funding for facilities, as well as partnership arrangements involving Federal and state governments (and industry), are appropriate.

S-1: State governments should develop comprehensive plans for academic research facilities on the basis of their views of the state's economic future, industrial profile, and labor force needs.

Background: A number of states have recognized the importance of their research and educational infrastructure to the long-term economic well being of their citizens, and have made investments that reflect this recognition. These investments are not confined to research facilities, but their programs demonstrate the ever-increasing degree to which state governments understand and are willing to deal with facility modernization issues.

A few examples:

- Washington State approved a $10.6 million High Technology Education and Training Act to support state colleges and universities in developing cooperative high-technology programs. This legislation includes funds to build a center at the University of Washington focusing on bioengineering, microelectronics, and materials science.
- The Arizona legislature appropriated $19.5 million for a new Center for Excellence in Engineering at Arizona State University; the associated 120,000 square foot structure, with the latest in technological research equipment, has already been completed.
- New Jersey has marketed a bond issue to support research facility construction. Local research centers specializing in critical engineering topics are being created; these are outgrowths of centers initiated earlier under the National Science Foundation's program of Industry-University Cooperative Research.
- New York, Michigan, and other states are establishing networks linking computer installations at academic institutions and other sites; these represent important potential components of a future national network.
- Tennessee has made a major commitment to its university system, in both instruction and research. Their program, announced in mid-1985, includes a $20 million/year commitment to build centers of research excellence in various state colleges and universities; $20 million for endowing chairs in research and teaching; and $10 million for instrumentation and equipment.

Comment: These are only a few outstanding examples of programs recently underway at the state level. The list could easily be extended; many states, among them California and Massachusetts, have long been involved in efforts to build research capacity. The conference participants emphasized the importance of state actions.

S-2: In developing their plans, states should consider a wide range of sources and techniques for funding academic research facilities.

Techniques include general funding, leveraging of private funds, bonding and other debt financing, lease-purchase arrangements, dedication of tuition payments to facilities, user fees and rents, and methods of managing indirect cost recovery funds.

State funding has been influential in generating industry support and commitment for research. Michigan has committed more than $21 million to establish a $100 million Industrial Technology Institute; the state is also providing $6 million for a Molecular Biology Institute at Michigan State University. Missouri provides 50 percent matching funds up to $950,000 for basic research projects, and 100 percent matching up to $475,000 for applied research projects. The West Virginia legislature has authorized up to $800,000 a year in matching funds for industry-sponsored research.

Bonding authorization from state legislatures is an attractive alternative to general fund capital appropriations. One-third of all state and local capital investments are financed through the issuance of tax-exempt bonds. With proper justification for requested projects and realistic funding for the necessary debt service, additional bonding authority appears to offer a good chance for new facility funding.

Earmarked taxes could provide a steady revenue source to continually construct, maintain, and renovate facilities. Traditional sources of revenue -- sales and income taxes -- are already heavily earmarked for counties, municipalities, and public education. Portions of new or additional taxes (e.g., severance taxes or taxes on liquor or cigarettes) could be earmarked for facilities.

State institutions should consider lease-purchase arrangements for the development of new facilities. The University of Arizona, for instance, acquired an Optical Sciences building through a lease-purchase agreement executed in 1969. The project was handled through the university's foundation, which borrowed from local lenders willing to provide funds because the university had a favorable long-term contract with a Federal agency guaranteeing payments. The lease-purchase method could be used to fund more facility construction if state operating funds were used for lease payments. This option would mean, however, that the burden would be largely placed on appropriated dollars to support this approach.

Tuition charges could be used for direct investments in capital projects or as a source of funds to service debt. This option may be difficult to implement under pressures to hold down tuition; state institutions are under particular pressure to keep tuition low to ensure that higher education is available to all.

Actions for Academic Institutions

In the course of the discussions, some participants commented on the planning and management practices of colleges and universities. The comments can be generalized as follows:

I-1: Institutions should improve their facility design, construction, and space management practices to reduce costs, to incorporate the best current practice, and to achieve better use of existing and potential facilities.

Comment: The economic situation, organizational structure, and management approach of each college and university differs. The traditional ethos of decentralized organization and shared governance does not lend itself to "orderly business practices" in institutional planning, budgeting, and facility development. Moreover, there is little communication among university administrators about good design and construction methods.

Modernizing academic research facilities on a national scale will require colleges and universities to adopt more efficient management practices, including state-of-the-art design and building methods. More efficient institutions will have a competitive edge no matter which modernization approaches are taken by Federal and state funding authorities. Improvements in design and management practices could also be communicated more effectively among institutions, enabling innovative approaches developed in one institution to be adapted to others.

I-2: Institutions should reinvestigate their funding sources and alternatives to assure themselves that available opportunities have been tapped to the fullest.

Comment: Most college and university administrations expend a great deal of time and effort keeping abreast of funding sources and programs. Nevertheless, each institution is urged to undertake a systematic and comprehensive examination of all its alternatives for research facility funding, with a view to expanding its "portfolio" of techniques, resources, and information sources.

Analysis of the advantages and disadvantages of various techniques as they apply to academic research equipment may be found in the June 1985 report entitled "Financing and Managing University Research Equipment", available without charge from the Association of American Universities, Suite 730, One Dupont Circle, Washington, D.C. 20036.

I-3: Institutions should design alternative approaches to indirect cost recovery; the Federal Government should encourage experiments with such approaches and evaluate them carefully.

Background: As discussed under action item F-1, better recovery of indirect costs is one approach that would permit institutions to finance facility modernization. In this context, a conference participant (Robert Sproull) proposed that standard cost recovery procedures be amended to use the concept of space rental for academic facilities.

In brief, institutions would be permitted to charge the equivalent of rent (per square foot of space used) for federally supported projects. The "basket" of costs covered by the rent would include depreciation, maintenance, security, grounds care, parking, and utilities associated with a particular facility. Rents charged by colleges and universities would also be based in part on, and could be compared with, market rents for facilities in an institution's vicinity. Other indirect cost items would be adjusted to some degree as institutions refine this idea and establish a new basis for cost pooling and recovery.

Comment: The Office of Management and Budget, granting agencies, and auditing agencies should work with groups of institutions to encourage this and other new approaches and to test them. Proponents believe that the concept of renting space associated with a project is more easily understood and more easily made comparable among institutions than are present methods of figuring and negotiating indirect costs. Many questions about the rental approach need to be resolved; these are set forth in Dr. Sproull's paper (included in Part III).

* * *

A final note on national recognition of the facilities modernization issue. Conference participants stressed that the scientific and engineering communities -- in academia, industry, and government -- must find more effective ways to communicate with the general public and with policy makers about the contributions of research advances to national goals and the relationship of modern productive facilities and equipment to making those advances.

CONFERENCE AGENDA

Monday, July 22, 1985

8:30 AM Registration

9:00 AM Welcoming Remarks
Dale Corson, Chairman,
Government-University-Industry-Research Roundtable

9:15 AM Overview, "The Search for Solutions"
Roland Schmitt, Chairman,
National Science Board

9:45 AM Concurrent Working Groups, Session I

11:00 AM Comprehensive Merit Evaluation and Research Facilities, Panel Discussion

Moderator: Dale Corson
Panel Members:
Bernadine Healy, Deputy Director
Office of Science and Technology Policy

Alvin Kwiram, Chairman
Department of Chemistry
University of Washington

Peter Likins, President
Lehigh University

Buddy MacKay, Member
U.S. House of Representatives

Alvin Trivelpiece, Director
Office of Energy Research
Department of Energy

12:30 PM Lunch, NAS Refectory

1:30 PM Working Groups, Session II

5:30 PM Cocktail Reception, Great Hall

Evening Complete Working Group reports as needed

Tuesday, July 23, 1985

8:15 AM Reports from Working Groups

Moderator: Dale Corson

8:15 AM - Reports
Working Group Moderators:
  Edward Bloustein, David Clapp,
  William Fassy, Kenneth Pikar,
  Thomas Stelson, Robert Wise, William Wells

9:15 AM - Response to Working Group Reports, Panel Discussion
Panel Members:
  The Honorable Don Fuqua, Member
    U.S. House of Representatives

  The Honorable George Darden, Member
    U.S. House of Representatives

10:00 AM - Questions and Comments from the Audience

10:30 AM Break

10:45 AM Reports from Working Groups, continued

Moderator: Dale Corson

10:45 AM - Reports

11:15 AM - Questions and Comments from the Audience

12:00 PM Observations, Conclusion, and Next Steps,
  Roland Schmitt, Bernadine Healy, and
  Dale Corson

1:00 PM Adjourn

WORKING GROUPS

1. Grants and Gifts (Federal, state, private sector; types, including matching, formula, block, set-asides, etc.)
   Moderator: Edward Bloustein, President
   Rutgers University

2. Alternative Sources of Finance (Loan guarantees, interest payments via grants, indirect cost recovery, borrowing, credit rating improvements, tax incentives, etc.)
   Moderators: David Clapp, Partner
   Goldman Sachs and Company

   William Massy, Vice President for Business and Finance
   Stanford University

3. Partnerships (Forms and types; possible cooperative arrangements, including inter-corporate, government-industry-foundation, inter-university; combinations with borrowing, grants, etc.)
   Moderator: Kenneth Pickar
   Research and Development Manager
   Electronics Laboratories
   General Electric Company

4. University Policies and Practices (Facility design; causes of obsolescence; depreciation obsolescence practices; maintenance, refurbishment v. replacement; restraint; etc.)
   Moderator: Thomas Stelson
   Vice President for Research
   Georgia Institute of Technology

5. Role of the States (Direct support; financial packages; debt; tuition charges; relations with private universities; economic development centers; etc.)
   Moderator: Robert Wise
   Assistant for Policy and Planning
   Office of the Governor
   State of Arizona

6. Comprehensive Merit Evaluation for Facilities (Present practice; alternatives; confidence-building measures; differentiation from individual research grants; etc.)
   Moderator: William Wells, Professor
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Working Conference on Strategies for Supporting Academic Research Facilities

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PART II: REPORTS AND STATEMENTS OF PARTICIPANTS

OPENING STATEMENT

OVERVIEW: THE SEARCH FOR SOLUTIONS

Dr. Roland Schmitt
Chairman, National Science Board

I am pleased to be at the opening of this conference, which could prove to be a landmark if we succeed in our objectives. We are addressing a problem of immense proportions -- variously estimated at $5-20 billion -- and addressing it at a crucial moment in time, a moment when there are several directions to take for solutions. I hope that we can find or invent some new, more promising roads to solving the problem of academic research facilities. For it is a problem that is not being solved. I'll start the process by asking some questions.

The facilities issue has been simmering for some time. But what sparked the sharp increase in attention that it is now receiving -- and what led to this conference -- was the emergence of the so-called "by-pass problem." In the past two years, 15 of our universities secured more than $100 million in Federal funds for facilities by means of direct Congressional appropriations that by-passed any merit review process. This development brought into sharp focus the degree to which the facilities problem has grown.

At the same time, the by-passing tactics used to meet the real and urgent needs of the institutions involved raised serious concerns in many of our minds -- concerns that led to a number of investigations of the problem. Among the most prominent have been the White House Science Council's Study of the Health of Universities, the Government-University-Industry Research Roundtable's study of Federal Funding of Academic Research Facilities, and the National Science Board's Report on Excellence in Science and Engineering. One of the Board's recommendations was to sponsor a conference, together with the Office of Science and Technology Policy, the National Academies, and the Government-UniversityIndustry Research Roundtable, to search for solutions to the facilities problem. This conference is the product of that recommendation.

The Board's report generated some concern -- in my view, quite understandable -- as to whether the science establishment was just trying to circumvent legitimate interests and actions of Congress, to preserve a status quo of inequitable distribution of NSF funds for science, or to use merit review as a smoke screen for what is really a power struggle between the ins and the outs.

These are not the central issues that we want to address at this conference. But we will be addressing them, and they are obviously important to what we are doing here today. So I'll make a few comments on them.

I believe that the primary point made by the Board in its report is still critical. If our objective is to maintain and enhance the unquestioned excellence and productivity of U.S. science and engineering, then abandoning merit review is a dangerous precedent. However, the strong reaction to the report highlights an additional point.

Maintaining the excellence of U.S. science and engineering must be only one of our objectives. We must also build and nurture new centers of excellence. I agree with those who say we need to pay more attention to this second goal. Our objectives must be both to strengthen and to build excellence. But there are still other issues that must be addressed.

First, merit-based review has been described as appropriate for funding individual investigator research, but less so for funding facilities. This view might be correct if we could separate bricks and mortar from research. But increasingly we cannot. We cannot do micro-electronics without clean rooms with air 100,000 times as pure as normal rooms, and with floors virtually free from vibration; we cannot do chemistry and biology without special ventilation and waste disposal facilities; we cannot do large-scale computation without computer rooms with carefully controlled environments. Thus, facilities and programs are more and more closely entwined in today's world and our answers must match this reality.

Second, merit-based review has been equated with inequality. That's true. Excellence in science is not an egalitarian objective. But how will other criteria lead to a better result? What criteria do we want to substitute for excellence? Shall we distribute Federal funds for facilities by region, by state, or by congressional district? Should we distinguish between public and private schools, schools with large endowments and schools with small endowments? Once we deviate from merit-based criteria, we quickly get lost in a sea of other possible criteria, none of which will build excellence as well as merit, and all of which will create their own forms of inequality. Certainly we do not wish to substitute the skill of lobbyists for the merit of scientists!

Finally, merit-based review has been challenged as inappropriate for creating new centers of excellence and talent. This is a legitimate question. Clearly, different criteria are needed to create excellence and then to sustain and strengthen it. These criteria might include judgments about the commitment and potential of the sponsoring institution, the creativity of its plan, and the realism and adequacy of its proposals for carrying out that plan. But are not these too merit-based criteria? And how do we assure that excellence is the hallmark of new centers of research?

We'll be reviewing these issues later at the session chaired by Dale Corson. So let me turn now to the primary issue before us today, the problem of funding academic research facilities. If we can generate and disseminate new ideas for solving that basic problem, then some of those other issues will vanish.

Our participants include representatives of the financial community, Congress, the state governments, Federal agencies, academic institutions, and business. This conference is aimed not so much at ventilating the problem as at exploring solutions. The nature and range of possible solutions are reflected in the titles of the working sessions that will follow my remarks -- Grants and Gifts, Alternate Sources of Finance, Partnerships, University Policies and Practices, the Role of the States, and Comprehensive Merit Review for Facilities.

What precisely is the problem? Well, "facilities" means many things. It means construction of new buildings, field stations, ships, and other research platforms, and renovation of existing ones; it means provision of the personnel required to operate and maintain them, and to handle their regulations, financial arrangements, and administration.

The particular facilities problem we'll focus on here is not the funding of unusual, one-of-a-kind facilities such as accelerators or ships, but rather coming up with the money for renovating and maintaining the more typical facilities for university research and education. I will not describe that problem in all its gruesome detail. We shouldn't let today's meeting turn into an exchange of war stories. Suffice it to say the following:

- The data show a substantial decline in investment for all sources of facilities.
- That investment decline has led to an unmet need for new construction or renovation that has been estimated at $5-20 billion over 10-20 years. To meet those needs, our universities would have to roughly double their annual facilities expenditures. But those annual expenditures have not increased, in real dollars, since 1968.
- In FY 1984 the total Federal investment in R&D plant in universities and colleges was only about $40 million -- virtually all for special purpose user and national facilities. Of all capital expenditures for academic facilities and equipment for R&D and instruction in science and engineering, the Federal Government's share has fallen from more than 30 percent in the 1960's to about 15 percent today.

This leads directly to my next question: Why is the search for solutions such a struggle today? After all, we handled the problem readily in the 1960's.

The difference is a growing gap between needs and responses. As far as needs go, we've entered a new era in science and technology -- an era of world-wide competition; of rapidly advancing frontiers in such areas as electronics, computer science, and biology; of a much tighter linkage than in the past between leading-edge research and cutting-edge industrial applications; and of a trend toward bigger science on the one hand and more capital-intensive science on the other. The cost of laboratories for individual investigators is growing at the same time as we enter the age of a space telescope, supercomputer centers, and perhaps a superconducting supercollider.

All these trends heighten the pressure on facilities far beyond that seen in previous eras. But our ability to respond is severely hamstrung. The deficit seriously limits the prospect for major new Federal initiatives directed at our universities. And the facilities problem is only one of a number of major science and engineering issues crying for Federal attention. We could just as easily be meeting here today to talk about the multi-billion dollar problem in instrumentation, or the decline in U.S. Ph.D. production in key areas of science and engineering, or the National Academy of Engineering's recommendation of a 275 percent real growth in the NSF's engineering budget over the next five years, or the National Research Council's recommendation of a 200 percent growth in Federal support for mathematics over the next five years, or the need to do something about the state of science and engineering education on the precollege and undergraduate levels.

So the needs are greater than ever -- but our ability to respond is severely limited. Which leads me back to the purpose of this conference: to seek solutions. A number of suggestions have been made, ranging from Congressman Don Fuqua's recent thoughtprovoking proposal for a $5 billion, 10-year Federal program of facilities funding; to David Clapp's proposal for an independent nonprofit corporation to fund facilities; to the proposal by Robert Sproull and others to modify the system of Federal reimbursement of indirect costs; to calls for a greater role for the states, the private sector, and our Federal labs; to redirecting a portion of government agency R&D budgets; to various forms of creative financing.

I do not intend to assess these alternatives here. That is the purpose of the conference. But this range of alternatives does lead me to a final question: How will we distinguish between appropriate and inappropriate solutions? I propose four criteria.

First, any solutions must deal with both the short term and the long term. A one-time infusion of funds is not sufficient. We must make the system able to cope with continuing demands.

Second, let's search for inventive solutions. A moment ago I used the phrase "creative financing." Don Langenberg, Chancellor of the University of Illinois in Chicago, has suggested that universities are "stretching their imaginations and resources to a prudent limit and sometimes beyond."

It may be that in a financial sense it is possible to become too imaginative. But I don't believe we need worry about that today. We need to generate imaginative ideas and turn them into inventive solutions.

My third criterion is unity. The nation's science community is a highly diverse collection of people. But there are some issues on which we agree -- such as the value of scientific and engineering research to the nation, and the value of modern facilities for such research.

We cannot afford to break up into factions that try to outflank one another by separate appeals to Congress -- particularly at a time when the constraints on new programs are as severe as they are today. The temporary advantages that individual institutions might gain would be more than offset by the long-term losses to the science and engineering endeavor as a whole. We must fight out our differences among ourselves -- at meetings like this one -- and then work together to achieve our mutual objectives.

Finally, let me add a fourth criterion for judging solutions -- excellence. We must continue to maintain the excellence of U.S. science and engineering, and we must redouble our efforts to create new excellence. We simply cannot lose sight of these two objectives because once we do -- once we submit to the temptation to make support for science and engineering an entitlement rather than something to be earned on the basis of merit -- we will have stepped onto a fast track to mediocrity.

And one thing that we should keep in mind: the system of supporting U.S. science and technology that we have had in place during the past decades, whatever its faults and problems, has passed the ultimate test -- success. The U.S. system has produced an outpouring of discoveries, knowledge, patents, and innovations of immense proportions. Whatever charges of inequity are leveled at the past, whatever changes are proposed for the future must deal with that fact.

So, to sum up, we're here today to search for solutions, not to detail problems. Let's clarify the problem where we can. But let's not waste a lot of time depicting it in all its detail. Let's put our energy into that search for solutions -- solutions for both the near and the long term; solutions that show inventiveness, reflect a united commitment, and serve both to enhance existing excellence and create new sources of excellence.

WORKING GROUP ONE: Grants and Gifts

Moderator: Edward Bloustein
President
Rutgers University

The group's conclusion was that we favor a facilities grant program not tied to indirect cost recovery, and without any provision for block grants to regions or states.

We believe that all those who are currently funding basic research, including the Federal and state governments, corporations, and foundations, should reexamine their funding programs to add facilities grant programs. But, and this is very important, such programs should only be undertaken if they represent a net addition to current funding of people and instrumention for basic research. To take them out of the current base would be destructive and would further impair our research capacity.

We believe strongly in matching requirements. They make good sense because, first, they do act as an important inducement, especially to private and corporate giving, but also to state appropriations. They also reflect conceptually the nature of the partnership involved and the nature of the joint interest in the success of the research.

These requirements also reflect the fact that universities, in receiving funds on this matching basis, are actually the objects of investment in many instances by corporations that have begun to regard universities as uniquely qualified economic entities for bearing long-range basic research costs. Corporations are beginning to regard universities in this respect as better able to bear those costs than they themselves are.

We do feel, however, that any matching program should maintain flexibility in its design. That is, the match required for different kinds of programs should vary from granting entity to granting entity, and from receiving institution to institution. One consideration in determining the match requirement should be the past effort of the institution in maintenance of its scientific basic research plant, and the match should not be determined only by the requirements of a specific facility. That is, the general tendency of an institution should be one of the criteria in determining the size of the match.

We believe strongly that matches should be made on merit, but we think that merit includes the potential for accomplishment, as well as the actual demonstration of accomplishment, both assessed by peers. We also believe that awards should be made independently of whether the institution to receive the grant is an independent or a public institution; that should be an irrelevant consideration.

We believe that we should be searching for new tax inducements for facilities, perhaps on the character of those that have already been provided for instrumentation, and we also recommend that some thought be given to a form of national recognition of those who make facilities grants, whether individuals or corporations.

Another consideration which we think appropriate in determining whether a grant should be made and what the match should be is the institution's level of expenditure for current and deferred maintenance. Such a requirement would have a salutary effect, we believe, in maintaining our existing plant while we build new plant.

Looking at all of the specific proposals, the group regards the Fuqua bill as coming very close to serving the purposes that we think should be served, and we support the bill in principle. We also as a group wanted to go on record as seconding Congressman MacKay's urging that the research community take a much more active role in providing political solutions.

Finally, we were very concerned that the program of facilities grants not skew the general level of support within institutions for nonscientific and nonengineering programs. In this respect, we think it very important that Title VII of the Higher Education Authorization Act be reauthorized and funded. And we think it would also be valuable for the new DoD university research initiatives program to include facilities.

WORKING GROUP TWO: Alternative Sources of Finance

Moderator: William F. Massy
Vice President for
Business and Finance
Stanford University

Our group examined the broad array of alternative sources of financing for academic research facilities and came to a number of conclusions about desirable programs in this area. Our first conclusion, not surprisingly, is that Federal Government support for research facilities is indeed an essential part of its basic research program funding. This is because science facilities are becoming more and more specialized. The technology is getting higher, the facilities are becoming more expensive, and the traditional sources of institutional support for facilities simply are not sufficient to do the job that needs to be done.

In particular, we are finding that there simply aren't enough sources with the capacity to provide the essential lead gifts on $10-20 million facilities or more expensive ones, that educational funds from traditional sources are in short supply, and that the states can and should help. Not enough of the benefits of basic research are internalized within the states to expect them to do the whole job. If the Federal Government does not help sufficiently, there will be too little capital input to basic research relative to the labor input, and that means the process will be inefficient and ineffective.

There are basically two ways of approaching Federal funding for facilities. (See tables.) Both are viable and, in the group's opinion, both are needed. First, there is payment up front by a Federal facilities grant program. Second, there is payment over time via the indirect cost procedure or through some kind of rental payments on individual projects. In the case of payment over time, the initial sources of capital are from the institution and its providers, including these days an increasing use of institutional debt as a source of capital.

These two approaches, payment up front or payment over time, differ on at least three important dimensions. First, with respect to access, payment over time limits access to those institutions and programs that can provide the initial capital required to build the facility -- capital that then will be reimbursed in part or in whole over time via the indirect cost system.

Facilities grants, on the other hand, mitigate the problem of access, in inverse proportion to their matching requirements.

Second, there is a difference in the mode of evaluation of proposals. Payment over time uses existing merit review mechanisms at the project level. That is to say, the assistance for facilities is in proportion to the institution's competitive success, or I should say its faculty's success with respect to peer review and other competitive mechanisms.

Facilities grants require a more aggregate program review or institutional evaluation. We did that sort of thing in the 1950's and 1960's but are not doing it now to any great extent. Certainly mechanisms could be put in place to do the job. Of course, it is also possible with institutional grants that the evaluations could be made on grounds other than merit, as we have seen in the by-pass problem.

The third dimension on which these approaches differ, and it is a very important one, is who takes a risk. The risk is that a facility, once constructed, will not produce the kind of research output (or not enable faculty investigators to produce the kind of research output) that was envisioned when the investment was made. That, after all, is what we are doing -- investing in research excellence in areas judged to be of high priority.

For payment over time, the institution takes the risk. That is to say, if the investment is made and in the future Federal research funding declines or the institution's share of that funding declines for one reason or another, it is the institution that is left with the problem. That problem manifests itself in a lower research volume base, higher indirect cost rates, possibly substitution of institutional funds for debt services or a failure to recover capital, or in extreme cases default on debt.

For facilities grants, of course, the Federal Government takes the risk, in proportion to its share of the funding. If excellence is not forthcoming, the institution, while not harm-free, is not at financial risk. It is at risk in terms of its reputation and good will.

The group felt that a strong case can be made for up-front funding, for example, a program of facilities grants such as that proposed by Congressman Fuqua. Such a program is important for a number of reasons. First, it will help to deal with the access problem: to make it possible for emerging institutions and emerging programs within established institutions to get the kind of facilities support that they need in order to move forward, even in those cases where the institution itself is not in a position to make the commitment of up-front capital and bear the risk. This, if you will, is similar to the "infant industries" argument that we see in other economic contexts.

Second, a program of up-front facilities grants can more closely align the incentives of institutions with those of government agencies by providing matching funds for programs that the Federal Government believes to be important and which have not yet been fully imbedded in the institution's priority structure.

Third, a facilities grant program does provide an alternative for by-pass, an alternative which can be pointed to when necessary and which provides by its mere existence an argument against use of alternative procedures or approaches.

There were some suggestions offered with respect to the particular bill that has been introduced. First of all, there should be some flexibility in the matching requirement. Fifty percent is appropriate for general incentive purposes, but some flexibility is required because 50 percent may defeat the purpose of providing access for emerging institutions. I think we concluded that matching is appropriate in principle but there should be some procedure to make adjustments.

Second, our group believed it is terribly important that enough new money be put into the system that the imbalance of capital and labor be made up with more capital rather than by taking funds away from current programs in order to provide the capital. We are very encouraged that Congressman Fuqua has introduced this bill, and we also, I think it is fair to say, support it in principle.

Notwithstanding the above, the magnitude of the need for facilities is so great that we are going to have to rely on the pay-as-you-go or payment-over-time method for a significant amount, perhaps even the majority of the amount, of academic research facilities that need to be built. That means we are going to have to rely on institutional capital, including access to private capital through the bond markets, in order to meet the need.

There are certain things that need to be done in order to facilitate that process. First, there need to be some changes to OMB Circular A-21, particularly with respect to the use charge, to make it possible to recover the costs through either depreciation or use charges in a time pattern that is more or less coincident with the pattern of repayment on debt. Because debt is inevitably going to be used to a greater extent than it has been heretofore, the time streams of payment need to be more aligned than they are now with the time stream of debt repayment.

Second, we need to recognize that new money will be needed here, too, because repayment of debt or repayment of institutional capital is going to mean higher indirect cost rates or rental payments. We are going to have to recognize the fact of this added burden if we are to avoid taking that money from ongoing programs.

Third, we should experiment with methods for linking facilities costs with whatever information is available about market rents for similar types of facilities in the geographic region. We talked a good deal about the mechanics of implementation. I think it is fair to say all believe that there is merit in the idea but that a great deal of work has to be done. It should be approached carefully, and we should use it as a source of information and comparison rather than a method of reimbursement, at least given what we know at this point.

Finally, and very importantly, the whole payment-over-time strategy is affected significantly by whether or not the tax-exempt bond privilege is maintained. This is of less consequence for the public institutions than the private ones, although my co-chairman, David Clapp, assures us that it is of consequence for the public institutions as well. He says they also would fall under a change in the law to a greater extent than they may realize.

If the tax-exempt bond privileges were lost, there would be an increase of two to three percentage points in the cost of capital for institutions. That, of course, would feed back to Federal research through the indirect cost system. But perhaps even more important, maturities for taxable debt are much shorter than the maturities available in the municipal bond markets. In fact it would mean bringing maturities down from about 30 years, which is what they are now for academic facilities debt, to perhaps 10 to 12 years. That would have a very significant effect on ability to finance research facilities over time.

We hope that a sufficient political argument can be made for separating college and university uses of tax-exempt bonds from the industrial development uses, which are under political pressure at this point. It is very important to maintain access to the tax-exempt bond market for academic research facilities.

Finally, the group spent a good deal of time talking about an idea presented by my co-chairman and one of his colleagues for the creation of a nonprofit financing corporation, perhaps federally chartered, for academic research facilities. This corporation would, in effect, pool the credit requirements for academic research facilities from a large number of institutions, both public and private, making loans to those institutions and doing the diligent work and evaluation necessary to evaluate those loans.

The corporation could possibly have a merit-based review system with respect to access to those loan funds. Having made the loans, it would remarket the securities in the secondary markets, very much like the Federal National Mortgage Association or the Student Loan Marketing Association. In the process, it would improve the risk characteristics of the debt, hence increasing access to private capital and making the whole process more efficient.

This idea would be enhanced significantly if the Federal Government would provide seed money for the corporation. An amount of $500 million was mentioned, a one-time payment that would be reinvested. It would provide a financial underpinning that could be used to mitigate further the risk of qualifying academic facilities, debt for the providers of private capital -- and also possibly assist with respect to interest-rate subsidies. We felt that this idea is worthy of very serious consideration because of the enormous leverage that such a corporation would provide in implementing a payment-over-time strategy for academic research facilities.

William F. Massey
July 1, 1985

CONFERENCE ON ACADEMIC RESEARCH FACILITIES

Outline of Alternative Sources of Finance

Type of Financing	Typical Source of Funds
A. Equity financing: payment up front	
1. University, school or departmental reserves	1. Accumulated from: o Funded depreciation charges, if any o Part operating surpluses o General gifts
2. Restricted gifts or grants from private services (lead or "name" gift, other gifts)	2. Obtained from: o Individuals o Foundations o Corporations
3. Line items in sponsored research or instruction agreements (grants or contracts)	3. With: o Corporations o Foundations o State and local government o Federal agencies
4. Joint ventures for research or instruction	4. With: o Corporations o Foundations o State and local government
5. State appropriations (public institutions only)	5. State government
6. Federal facilities grants[a]	6. Federal government

CONFERENCE ON ACADEMIC RESEARCH FACILITIES

Outline of Alternative Sources of Finance (continued)

Type of Financing	Typical Source of Funds
B. Debt financing: payment over time	
1. Tax exempt bonds and notes[b]	Applies to all sources (B1-B4) Interest payments: o Indirect cost recovery (external interest is allowable on Federal grants and contracts) o Line items in sponsored agreements o General income, gifts, etc. o Restricted gifts Principal repayment: o Indirect cost recovery (depreciation charges) o Line items in sponsored agreements o General income, gifts, etc. o Restricted gifts
2. Taxable bonds and notes[c]	
3. Government loans (subsidized or unsubsidized)[a]	
4. Government guaranteed bonds and notes (tax exempt or taxable)[a]	

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[a] The federal government currently has no general programs applicable to research facilities.

[b] Access of private institutions to tax exempt financing would be eliminated under the Treasury II tax reform proposal. Public institutions would be unaffected. The result would be to further increase the gap between the tuition and fees and the indirect cost rates of private and public institutions.

[c] Used mainly by private institutions when access to tax exempt financing cannot be obtained.

WORKING GROUP THREE: Partnerships

Moderator: Kenneth Pickar
Vice President
General Electric Company

The group was asked to examine the role of partnerships in solving the facilities problem, but maybe I should begin with a cautionary note. We concluded that the scope of the problem is well beyond the size of any solution suggested so far. That is, there is no combination of universities and industries that would have a substantive effect on the problem with token Federal Government participation. That says that a comprehensive solution can only be obtained by the injection of significant amount of Federal funds, and we therefore endorse mechanisms outlined in the Fuqua bill and by the Sproull proposal to obtain these funds.

This is not to say that partnerships between universities, states, and industry cannot be useful, both in themselves and to leverage the political process at the Federal level. I would like to cover, then, on a sector-by-sector basis, responsibilities and opportunities to generate funds for partial solutions.

First, we discussed corporations, which are traditionally motivated by shorter-term profit motives. Companies prefer program funding over capital funding for their university programs because of the greater leverage they derive from financing directed research rather than overhead. In fact, companies tend to help create cost-recovery problems for facilities by negotiating for lower overhead charges.

However, the nature of industrial research is changing and we may be able to take advantage of the evolution in the research environment. Some positive ideas came out of our discussion.

One is that companies are realizing that focus is required in industrial research, that no company can do it all, and that research can be effectively leveraged through universities. One participant estimates that 30 to 40 percent of his future industrial research effort could be funded at universities. That trend leads us to joint research programs. One can visualize sharing of expensive pieces of analytic equipment, both for back-up and for joint projects.

But what about the more difficult area of facility sharing? Here one could envisage condominium laboratories jointly funded, with portions allocated to the university and the individual corporations. This would represent a step beyond the incubator facilities now existing at a number of locations.

These condominiums could be either new or, even better, remodeled laboratories where for the price of maybe half of a new facility an obsolescent building could be brought up to modern standards. In fact, one could even conceive of selling campus laboratory space outright to industry (beyond the condominium mode). Although concerns were voiced, for example, about problems that could arise from the integration of industry into the university campus, the idea was felt to be worth exploring. The strongest point in its favor is the increasing convergence of research purpose between corporations and universities.

With respect to direct contributions, we felt that tax benefits should be granted for contributions toward funding buildings, similar to benefits received for the contributions of equipment. The distinction that is presently made between research instruments and modern facilities is purely artificial.

To enhance leverage on the Federal level, the enlistment of the construction industry might be a good idea, as it would clearly serve to benefit from any massive infrastructure rebuilding program.

And one more item: the time when corporations have the greatest influence on states is when they are thinking about relocating either factories or laboratories. We are all witness to the competitions that have existed. We see no reason why the attitude of a state toward the scientific facilities in the university shouldn't be one of the criteria for a corporate site selection. This voiced concern of infrastructure as an index of excellence would cost the industry nothing and could have a substantial effect in leveraging state interest.

With regard to the states, their motivation is quite clear--to create economic opportunity for their citizens. The working group was surprised to learn that there is some evidence, at least in some states, that universities have not aggressively sought available funds. We recommend that each university should examine whether money is not being "left on the table."

We addressed the issue of technology parks, and the evidence so far is rather mixed. There are very few examples of successful technology parks, with Stanford the prime example of success. However, even though the results are not yet in, we think that such parks are well worth pursuing because to the state they represent results from the university/industry joint endeavor right where the state is looking for results.

What about the Federal Government? It appears to us that the Defense Department is the only department with enough funds to attack the problem seriously. Educational campaigns should be mounted along the lines suggested by Congressman MacKay. In addition, one could even make an analogy with the successful Federal interstate highway program, a previous multi-billion dollar capitalization that was considered defense related.

There are proposals before the Congress to allocate in the next three years $25, $50, and $100 million, respectively, for university infrastructure. We, of course, strongly endorse this proposal. The key is to change the DoD thinking from a procurement to an investment strategy.

The argument has been that only the Federal Government had enough resources to do the job, but that doesn't let the university, industrial, and state partners off the hook. One strong point that emerged was the value of bootstrapping. For example, although companies will not generally donate buildings, they will contribute equipment and program support. Many will join industrial affiliates programs (in fact, we don't know why every university has not selected its strongest departments and created at modest cost an industrial affiliates program). Then the industry and university initiative can be bootstrapped by the university to obtain state support for building infrastructure and Federal support in its many forms. Group members provided a number of anecdotal examples where this was done very effectively.

The Federal Government has played a very positive role in this process. For example, one can see the example of the Engineering Research Centers galvanizing industrial and state support throughout the country. In sum, although the problem is daunting, the circumstances by no means preclude starting with a million or two million dollars and parlaying it to much larger sums.

Let me conclude with some recommendations. First, although for the purpose of this meeting it was desirable not to get bogged down in defining the problem, the group felt that we cannot go much further without understanding more about the scope and the nature of the challenge. We recommend, therefore, that hard data be gathered by the National Science Board to substantiate the situation (as already directed by the Congress). We suggest that the Conference Board and the Industrial Research Institute could render assistance, if necessary.

We would also like to state parenthetically that, although we have had a focus on research facilities, the problem of obsolete undergraduate laboratories is strongly coupled with the issue of academic excellence. We had really no good idea at all of how large a problem the undergraduate component is as a fraction of the total facilities shortfall. However, the strong feeling was that it was significant.

Second, we recommend that the Secretary of Commerce charge a commission to study the problem of our inadequate and deteriorating university research infrastructure and its effect on national competitiveness and economic development. We suggest the model of the Gardner Report, which had a galvanizing effect on American education.

In persuading the Congress of the importance of renewal programs in our university research facilities, we feel that the credibility of the effort is greatly enhanced by a strong input from business. Universities can be accused of being self-serving on this matter. Business cannot. We recommend that a number of business/university organizations be contacted on this issue, and that a white paper be written to help galvanize the endeavor. One particularly appropriate organization is the Industrial Research Institute. Others include the Council on Chemical Research, the Semiconductor Research Corporation, the Pharmaceutical Manufacturers Association, the Electric Power Research Institute, the Gas Research Institute, the Edison Research Institute, the Business-Higher Education Forum, the Conference Board, and many others.

We also support new DoD initiatives for university research. In principle, contributions should be rendered by DoD in proportion to the need for instrumentation, facilities, training, and programs. We also recommend that tax credits for donations toward the construction of facilities be added to the tax law, co-equal with the purchase of equipment.

Finally, a perhaps unnecessary cautionary note: there was some fear that a closer relationship between industry and universities could subvert the universities. I think the stronger opinion had it that this would not occur. All the representatives from industry felt that it was in their best interest that the universities' purpose remain education, not training. Furthermore, the major advantage this nation has in the world's competitive marketplace is the creativity of its scientists. Anything that inhibits this creativity would hurt us, but the programs outlined above would serve to enhance this creativity and not compromise it.

WORKING GROUP FOUR: University Policies and Practices

Moderator: Thomas Stelson
Vice President for Research
Georgia Institute of Technology

This group agrees that many positive developments are underway. Many institutions have used new and more effective ways to meet the facilities crisis. Documentation and communication about successes would be helpful. There isn't only hand-wringing, and we aren't just passing on our problems to the Federal Government for solutions. We are in a working partnership, and could do better if we had more communication and transfer of constructive ideas.

For example, space management is closely connected with facilities problems. Most universities could probably do better with space management, which has a significant impact. So we think more concentration, more communication, more self-help on our part would contribute to a total solution.

Second, we agreed that among us there is tremendous diversity. There are public institutions, there are private institutions. Different ones vary tremendously with respect to the age of the institution and the age, size , and purpose of the facilities. We have universities in urban environments, we have them in rural environments. We have tremendous differences in program mix. We have different fiscal and accounting systems. We have different sources of funding, tremendously different resource bases.

So our consensus on this point is that no matter what the program ends up being, it should have a maximum amount of flexibility because we have such a diversity of needs and conditions. There should be some array of mechanisms, not just for new facilities, for example, but for renovating old ones. Some of our institutions are still growing fast. Others aren't. So there is a tremendous difference in what we need and what kind of a Federal program would be most suitable and helpful.

A third point dealt with facility design and construction. In many institutions there is a long period of time between the design and construction of one research facility and the design of the next. Many institutions don't have much talent with respect to facility design, construction, and so forth. Furthermore, we are hampered by operational and bureaucratic problems. Research facilities especially may not fit well with building codes, with specifications at the local, state, and Federal levels. For example, simple changes in laboratory specifications can change the energy-use rate of laboratories by a factor of about 10. Back when energy was cheap, that wasn't so important, but today it is. Furthermore, there are all kinds of new control systems, and we are unfamiliar with many of these, because, as a total community, we haven't been building much recently. Our design and construction systems are probably antiquated and weak and relatively unsatisfactory if we are going to enter into a new period of facility development.

Some disciplines have good communications. They pass around information about new facilities, what is good and what is bad, what the costs are, and so forth. More communication would probably be helpful, and we think that this is a major need and that we ought to get started on it fairly soon instead of waiting until the money appears.

A fourth item deals with depreciation, obsolescence, life-cycle systems, and the mixture of operational factors. The current use charge of 2 percent or a 50-year building life is just totally unrealistic. We ought to go to 5 percent (20 years) for research facilities. There should also be differential rates for different kinds of buildings, not uniformity as we have now. We fully realize that going to realism could have a large impact on the indirect cost recovery system. This could shift money from direct to indirect costs. But continuing to live with an outdated and inappropriate set of accounting cost standards is a dead end. Indirect cost recovery can be very useful and important to some institutions, or it may be rather worthless to others.

Our current standards are so bad that they hamper effective use of those mechanisms by institutions. Furthermore, the great thing about this approach is it is not compulsory. Thus, it provides another dimension to flexibility that we do not currently have and think is important.

Now with respect to the Fuqua bill, we have one suggestion. In our group there were differences with respect to facility problems between different disciplines, and there are clearly going to be differences with different Federal agencies. Some areas have a far greater facility crisis than others. We looked at both short-term and long-term approaches. We think that 10 percent of the program budget is a good long-term facilities funding level. How to get from here to there is the problem. We recommend that the funding mechanism -- and we would like new funds -- include a certain time period that might vary among Federal agencies. One agency might get to 10 percent in one year and another might take five years. As soon as they reach 10 percent, though, that rate would be locked in as a proportion of the total funding from that agency, to take care of the longer-term problem of facility financing.

Those are the five points on which our group reached consensus.

WORKING GROUP FIVE: Role of the States

Moderator: Robert Wise
Assistant for Policy and Planning
Office of the Governor
State of Arizona

In terms of trying to provide a historical context for the state role, it is clear that the Federal Government has been mainly interested in national development and building the national defense over the past years. State interests have been clearly and mainly focused on public education and research and service to the state. However, since the 1960's, the Federal decline in funding has been fairly precipitous, and the states, in some cases, have tried to fill this gap. Within the last couple of years, it appears that the states are spending more money on research and education.

Now the Federal Government is more concerned than ever with national defense and national security, which dominate the Federal budget, and it is increasingly concerned with the international competitiveness of our basic industries.

This situation leads us to the conclusion that fundamentally, the states, the Federal Government, the private sector alone cannot do the job of providing science facilities; this must be done in a partnership. State contributions vary cyclically and by funding source. There seems to be a current upward cycle that has been documented in terms of aggregate state spending, but this moves directly with the economy. Second, the core state responsibility is to provide fundamental support for the universities; provide higher education for citizens to increase their opportunity in a democratic society; improve the quality of life; and meet basic cultural and literacy needs.

Recently added to this list is what one analyst has called a grass-roots industrial policy for economic development -- detailed activities the states have undertaken with the private sector. States also vary as to their needs because of the growth and decline of different regions and economies. One state may need renovation and restructuring of its basic facilities, while others need new facilities; this is really a difficult priority-setting problem for each state and institution.

Fundamentally, research facilities should be considered part of educational excellence and a service to the state and the nation. Research facilities might have a difficult time being justified on a stand-alone basis. State responsibilities clearly should be, first, a definition of the roles and missions of the institutions within the state and, second, long-range planning and capital budgeting for the needs of the state and its institutions. States also must provide the environment of cooperation and alliance with the private sector, which in fact is the justification many states are using to expand research in academic facilities at this time.

Each institution and state must marshal state sources of financing and techniques for facilities as best they can. These include general funding, the leveraging of private funds, bonding and debt financing, earmarked taxes and special sources of funds, lease-purchase arrangements, the dedication of tuition increases to facilities, facility debt financing, user fees and rents, private sector donations, and indirect cost recovery management.

Finally, on state roles: states should basically link research facility needs with their concepts of the state's economic future, industrial profile, and future labor force needs.

In terms of Federal responsibilities to the states, we identified a number of important criteria for Federal programs and responsibilities. First, our group strongly agreed that a stable and longer-term facility and program commitment will encourage positive state participation. What seems to be a small add-on program without any real stability may not encourage a long-term stable response by the states.

Second, funding should be approached for facilities on a total cost basis, with the understanding that support should include the operation and maintenance of a facility. There were examples mentioned of facilities that were poorly planned and did not have adequate management on clearly defined roles for the partners.

There is a need for flexibility, for shifting within the categories of funding from the Federal level and the state level. At present many changes are contemplated in the

Federal tax law and other areas. These changes, including restrictions on industrial revenue bonds and accelerated depreciation, will diminish state and private facility funding without increasing alternative sources.

Federal financing will require mixed use of indirect cost recovery, grants, loans, fees, rents, dedication, and possibly other techniques, and no one technique is seen to be the overall answer. A Federal program should have a matching component, and we believe that is a way the states can leverage their participation in a program. Finally, in terms of a political strategy, it was fairly clear that private industry will play a key role in supporting any expansion of research facilities and instrumentation, both at the state and Federal levels.

WORKING GROUP SIX:
Comprehensive Merit Review for Facilities

Moderator: William Wells
Professor
Department of Management Science
George Washington University

Three sets of products emerged from the group's deliberations. One of these was a draft statement of basic principles for research facilities funding. The second product was a modified version of the forum staff paper on comprehensive merit evaluation of academic research facilities. Third, several recommendations were made during the course of the day. Essentially, these called for further study of several matters.

Let me begin with the individual recommendations for further study. The first is essentially a reiteration of the point Ken Pickar made about acquiring a firmer data base on the actual status of the research infrastructure. A canvass of attendees in the room yesterday revealed that no one knew of any comprehensive study that had been done. There are plenty of anecdotes, numerous mini-studies, and a considerable number of individual studies at various institutions, but nothing that could accurately be called a national review of the status of this very important national asset.

A second canvass of conferees pointed to the absence of any major, comprehensive study of the decision processes used by various government agencies in the past several decades to make decisions on research facilities. This led to a recommendation that there be, in terms of adding to the existing but limited data base, a more systematic examination of past decision-making processes.

Third, there was a recommendation that more detailed guidelines be developed to implement research-based faculty programs. This point was reflected partly in the statement of principles and in the revised draft working paper.

Let me turn now briefly to the statement of principles that resulted from our deliberations, not so much as a specific set of recipes, but more or less as a basis by which we could generally look at the broad subject of research facilities.

The statement of principles consists of four points. First, the scientific and engineering communities reaffirm their belief that both the obsolescent of the infrastructure for basic research and a failure to meet the need for additional facilities constitute a threat to the national interest, in terms of both national security and international economic competitiveness. We urge the Congress and the Administration to authorize and fund a continuing, stable program of support for the nation's research infrastructure.

Second, the scientific and engineering communities reaffirm their commitment to a process that includes a careful and objective review of the technical merits of proposals for the construction or renovation of research facilities. Further, the communities express their willingness to work with the Congress, or agencies designated by Congress, to provide evaluations of any broader issues relating to the long-term well being of basic research that bear on decisions about the development and location of such facilities.

Third, the scientific and engineering communities recognize the interest of Congress in the development and location of major research facilities, which inevitably affect the economic, social, environmental, and other circumstances of the regions, states, and communities in which they are located.

Fourth, the scientific and engineering communities express their willingness to work with the Congress, or agencies designated by Congress, to develop specific guidelines to implement of new procedures consonant with these principles and appropriate to specific programs or circumstances.

The third and final group product was a revised version (attached) of the draft paper on comprehensive merit evaluation in connection with Federal funding of academic research facilities. The paper gives a very brief overview of the history of research facility reviews and selection procedures used by several Federal agencies in past years. It describes the traditional peer review process associated with research projects, then outlines a suggested set of criteria or features that could or should be used in evaluating research facility proposals. Based on this framework, the working group members spent the afternoon discussing the various factors and attempting to come to some agreement.

The Working Group revised the draft as follows: First, we introduced a review of the National Science Foundation's program which went beyond considerations of scientific or technical merit in allocating funds to a number of states with limited research capacity.

Second, we worked on a paragraph of major concern. It required a considerable amount of debate and deserves highlighting. This paragraph reads as follows:

> "Given the extent of the interest in facilities, the merit review of facilities proposals is likely to be complex. Other factors of a more social, political, and economic nature also are relevant to determining the decision. These may include geographic distribution, the contribution to local and regional economic development, and the willingness of the institution, of the state, or of the region to share costs."

Third, we summarized the rather lengthy discussion regarding the University of Washington by simply putting in two paragraphs that describe generally the political role in research facility funding and location. We concluded that, for a paper of this type, the use of a general concept was superior in value to any one set of specific details -- a number of which might be in dispute.

Finally, in the most important feature of the paper, which deals with the formulation of comprehensive merit evaluation, the group came to a general formulation after extensive debate. I must note that there was a rather strong minority dissent to the use of the term "comprehensive merit evaluation." The minority believed very strongly that the use of such a term would implicitly involve a recognized or acknowledged departure from the traditional peer review system in connection with research facilities. Several members present indicated that the boards of their organizations had taken very strong positions on this issue.

Therefore, the group report, in effect, presents to you a divided view: the majority agreed to the concept of comprehensive merit evaluation as proposed in the forum draft paper; the minority strongly disagreed.

Attachment

Working Group Six -- Attachment

FEDERAL FUNDING OF ACADEMIC RESEARCH FACILITIES

Comprehensive Merit Evaluation
July 1985

Introduction. In the years following World War II, American research universities built research facilities adequate to support a vigorous and high-quality research effort in science and engineering. These were funded in many ways: with state appropriations in the state universities, with gifts in the private universities and, in the 1960's particularly, with Federal funds. During the past two decades, national investment in research facilities has declined markedly. Significantly diminished Federal support is a notable factor. As a consequence, academic research facilities have reached a state of obsolescence and deterioration that threatens the quality, and the international standing, of American science and engineering.

Interest in modernizing these facilities is growing, but in the present period of Federal budget stress only modest Federal funds, at best, are likely to be available for the purpose. The funds that are available, or that become available, must be used in the way best designed to serve the national interest. The decision-making process by which selection is made from among all the contenders for those limited funds is all-important. This paper discusses some of the considerations bearing on that process. Parts of the discussion also apply to related allocation decisions by states or foundations.

Review of Individual Research Proposals

A. Merit Review: Merit review has long been a part of Federal research-supporting programs. Research proposals have ordinarily been reviewed through mechanisms designed to select, from among all those submitted, the proposals that are judged to be of the highest technical quality and thus best promote high-quality science and engineering. Ordinarily, scientists and engineers who are acknowledged experts in the fields at hand have been chosen to make the reviews.

Systems for the review of individual research proposals vary from agency to agency. Procedures sometimes include assembled groups of reviewers, and in other cases proposals are referred to selected individual reviewers. In some cases the review is conducted by technical staff within the agency. The National Institutes of Health use assembled groups in a two-tier process in which the first level of review is scientific and technical and the second considers the awarding unit's mission, along with other relevant matters.

The central feature, however, of all such reviews is the use of recognized experts who are qualified to judge the significance and the relative quality of the proposals at issue. Within the proposals judged to be of high quality, agency staff normally execises some discretion, based on available funds as well as other criteria, in deciding which proposals to fund. The factors considered by the staff vary from agency to agency and from field to field but include relevance to program objectives, congressional intent, and other concerns of a social and political nature.

B. Special Considerations for Individual Grants: On occasion, special programs are established, parallel to those supporting the most excellent research, to further specific national objectives, such as geographic distribution or human resource development. For example, the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCOR) was instituted to develop the research capability of investigators in states with limited research capacity.

Review of Facility Proposals. In evaluating proposals to fund academic facilities for research and teaching in science and engineering, the scope of the review necessarily broadens. While facilities are central to the scientific and academic goals of the universities, they are also high-cost and high-visibility items, calling for evaluation procedures somewhat different from those employed for research proposals. This is especially true in the present climate, where university science and engineering are viewed as important components of economic development and where the surrounding community or geographical region perceives new academic facilities to be important.

In selecting a review process for academic facilities, funding agencies seek a means of judging the merit of proposals for achieving all the objectives established by Congress and by the agencies.

The technical features of such review are designed to ensure that:

1. The existing or proposed programs of the institution in question are adequate to achieve the stated goals.
2. The people in place or proposed for conducting the programs proposed for the facility in question are capable of competent execution of the programs.
3. The proposed institution is able to achieve the goals intended by Congress and the agency involved.
4. The capacity of the area, or of the institution, is adequate to provide the transportation, communication, supplies, water and other similar resources, and other necessary services.
5. The cost of the facility will be reasonable.

Sometimes the ability of the institution to meet these criteria depends on commitments by other bodies, such as the willingness of a state to fund new positions if Federal support for construction of the facility is assured.

Generally, those called on to make these judgments are selected, by procedures established by the Federal agencies, from among recognized experts in the fields in question.

Given the extent of the interest in facilities, the merit review of facilities proposals is likely to be complex. Other factors of a more social, political, and economic nature also are relevant to determining the decision. These may include geographic distribution, the contribution to local and regional economic development, and the willingness of the institution, the state, or the region to share costs.

Examples of Review Systems Used in the Past. Where the largest-scale facilities are involved, many considerations enter the picture. In the case of the National Accelerator Laboratory (Fermilab), more than 100 proposals were received by the Atomic Energy Commission. The Commission screened the sites to ensure that they met the basic requirements, including adequate power and water supplies, land areas, housing, and transportation capacity. Once these determinations had been made, a committee of experts assembled by the National Academy of Sciences further reduced the number of proposals to those that met all the requirements for a successful national laboratory. This refined list was relatively short, and any site on the list was technically satisfactory. The Commission made the final selection, taking into account all the relevant social, economic, and political priorities.

An example on a smaller scale was the National Science Foundation's Science Development Program -- the "New Centers of Excellence" -- in the 1960's. The goals of this effort, as documented in legislative history, were the development of new centers of excellence and the general improvement in the quality of science and engineering education. Wider geographic distribution was a primary objective. The Foundation established an advisory committee of scientific experts, who studied every proposal. On the basis of proposal quality, reports of independent site-visiting teams, and criteria established by the Foundation, the advisory committee made its recommendations.

A major consideration in the final recommendations involved judgments about the likely gain in scientific productivity per million dollars invested. Other considerations involved the commitment of state governments to provide matching grants to their competing universities, and the capacity of the proposing universities to recruit and retain faculty competent to conduct the new programs.

Discussion between the advisory committee and Foundation staff was an important factor in the deliberations. In the end, the funding decisions were designed to serve the ends intended by Congress in appropriating the funds.

In some cases agencies have relied on their own technical staffs to provide the necessary evaluation of proposal merit. The case of the NASA Sustaining University Program of the 1960's, one-fifth of which went for facilities, is an example. Competing proposals were reviewed internally and decisions made by the NASA Administrator on the basis of anticipated return on investment. The extent of an institution's involvement in NASA research was a major criterion.

A procurement model was recently used by DoD in selecting the site of its Software Engineering Institute. The impetus for the Institute came from DoD in its FY 1985 budget proposal, and the line-item funding provided by Congress was free of directive constraints. with the appropriation in place, DoD advertised in the Commerce Business Daily and the Federal Register. More than 200 responses were received, and each was sent a Request for Proposal. The specified proposal criteria included relevant considerations bearing on the success of such an Institute.

Seven proposals were received, and these were reviewed first by an evaluation board that included civilian and military DoD personnel as well as NASA and National Security Agency representatives. This board was selected for its technical competence, and it limited its evaluation to the technical merit of the proposals. Site visits were included. The next level of review was conducted by senior DoD executives -- civilian and military. The final decision, to award the Institute to Carnegie-Mellon University, was made by DoD's Undersecretary for Research and Engineering.

While substantial lobbying was acknowledged, DoD asserted that the final decision was made on the technical merits of the winning proposal.

Political influence has been a major factor in some cases, but its extent and pervasiveness are debatable. The emergence of the University of Washington as a center of excellence in biomedical research and medical education is often cited as an example of the salutary influence of political interest.

Another view holds that the growth of this medical center was apolitical -- the absence of line-item appropriations and the submission of Washington proposals to expert review support this view. This version holds that there were ample funds to be applied for -- by Washington and by all other qualified institutions.

Sometimes there have been no merit reviews at all as in the case of several proposals funded through floor amendments to various appropriation bills during the past two or three years. There are several possible explanations for this development:

1. The physical plant established at universities during the 25 years following World War II is aging.

2. Maintaining research and teaching programs at the frontiers of science, meeting health and safety standards, and following best laboratory practice all require modernized facilities.

3. University administrators seek to raise funds from all sources to meet facilities needs. Since there are almost no categorical Federal programs that fund facilities, administrators go directly to Congress. (They also go to private foundations, corporations, and state governments.)

4. Members of Congress are willing to help because they were elected to promote the economic and social development of their districts as well as to serve the national interest.

Comprehensive Merit Evaluation. From these examples and the preceding discussion, one concludes that the allocation process for research facilities is not exclusively the result of a competition among proposals for identical facilities. Rather, the process is the result of an evaluation on a case-by-case basis of technical merit, local capabilities and aspirations, and other factors that impinge on the ultimate success of each individual facility proposal. Such other factors include social, economic, and political considerations. For these reasons, the phrase "comprehensive merit evaluation" best describes the process for review of research facility proposals.

PANEL ON COMPREHENSIVE MERIT REVIEW

Statement by
Bernadine Healy
Deputy Director
Office of Science and Technology Policy (OSTP)

It seems clear, and not just by this assembly, that research facilities are a pressing problem at our universities. The university sector sees facilities and equipment as possibly its leading problem. We have been exposed to this at OSTP through our ongoing panel on the health of universities, which is chaired by Mr. David Packard and Dr. Alan Bromley. Industry, academia, and various sectors of government have told us repeatedly that facilities are a major problem. With this broad-based concern within government (both the Congress and the Administration) and in the private sector, various points of view seem to be converging on this as an important issue that needs to be addressed now.

I think that by-passing the established system of merit-based awards by funding facilities through assorted Congressional actions is as much as anything a symptom of the pressures that universities in different regions of the country have been facing, rather than being a calculated frontal attack on the merit system. Even the institutions that have benefitted from Congressional by-pass strongly endorse the merit review system, at least in principle.

In the course of addressing this problem, it is always important to focus on a few important traditions or governing principles that have characterized the research system as it has developed in this country. The university-based research system in the United States is rather different from others elsewhere in the world. We should not lose sight of its unique character and its strengths in the course of addressing this problem. Let me suggest but a few of these strengths.

Clearly, one major strength of our system is its diversity. We have a wide range of private universities and colleges, of state universities, and of local academic institutions. We have seen a great deal of public investment from the states and local communities, and also from the private citizen in the form of philanthropy. Despite a large Federal investment, the individual character of our institutions has been preserved.

The quality of the research that comes out of this system is in part a reflection of that diversity, and whatever we do to try to solve this problem of infrastructure and equipment should not homogenize the system. In so many ways the diversity is linked to intellectual freedom and creativity and the ability of each institution and its investigators to go their own way scientifically. When one contemplates central solutions to problems that affect diverse populations, we should make certain that the central solution does not stifle this strength. Any approach should be attuned, for example, to the importance of the public/private blend that has worked so well both with our universities and also in our state university system.

A second important strength or contributor to strength is that we have a system of Federal investment in university research that is merit based. We should invest in infrastructure and equipment based on excellence and relevance as we make project grants. That means infrastructure and equipment are as much a cost of research as are the direct expenses associated with laboratory work.

That is why indirect cost recovery provides one approach to dealing with the infrastructure and equipment problem. This approach affords us the ability to keep a tight coupling between the actual research that is being done and the infrastructural requirements that make that research possible.

Another of the great strengths of the university system in this country is that there has always been opportunity for new entries into the field. In fact, our national heritage is based upon opportunity to excel based on merit, whether it be in people or institutions. And our system has always afforded opportunity to move up based on merit. Whatever changes one devises, one must give careful attention to preserve that fluidity so that the so-called "B" institutions can become "A" institutions and compete on equal footing with the rest.

This does not mean approaching "B" or "C" institutions in an entitlement mode, with the view that just because they exist or are in a certain region of the country, they are entitled to have some money. Rather, the "B" institution should have the opportunity to become an "A" institution; once that is achieved, it should have access to whatever opportunities are available on a competitive basis. An important point: the initial upgrading of an institution has not been and probably should not become a Federal role -- that has been the role of the states, local communities, and private philanthropy.

Broadening the base of "A" institutions is a goal which is reasonable, and in which we in fact have excelled. We can see around us many young institutions that have moved into the ranks of the best funded research universities, all in the course of the past decade. And this means that today the base is much broader than it was. The other side, of course, is that the competition is therefore stiffer -- more institutions are competing for the same opportunities.

Statement by
Alvin Kwiram
Department of Chemistry
University of Washington

Sometimes, in moments of wishful thinking, some of us believe that we are supported to do basic research for its own sake. More realistically, the funding comes largely because the Federal goal is to build a strong economy in a productive society. I think if one takes this goal as a starting point, then one sees implicitly a dual requirement.

First, technical review is essential, otherwise one has no guiding principle to go by. Second, as the NSF enabling legislation points out, the goal is to strengthen basic research and education throughout the nation; note also the emphasis on both research and education. That suggests that there are additional economic and social factors which have to be taken into account. Hence the proposed comprehensive merit review idea is appropriate and realistic.

There are only a limited number of sources available in the nation that are commensurate with the scale of the problem we face in terms of facilities, instrumentation, and infrastructure. Because of that, in my mind, there is no option but to expect that the Federal Government will play the leading role. Our experience in the Council for Chemical Research, in evaluating this problem at some length over the last several years, is that there is simply no way that industry sources can play an adequate role. They will certainly play a complementary role, and it is in their self-interest to participate and support the Federal effort, but their resources are limited. Moreover, their justification to their stockholders for using resources in this manner is problematical.

Since basic research is fundamental to the national welfare, it must be a national priority, and in my view, neither the Federal science establishment nor the scientific community itself has done enough, aggressively enough, to present the needs in a way that is compelling and convincing to society at large. I am particularly encouraged by this conference, which I feel is an excellent step in that direction.

If the Federal agencies take a more aggressive role by providing leadership and appropriate incentives (and obviously that also means money), significant additional resources from states, from industry, from foundations, and from private sources can be brought to bear on the problem. I think that a substantial initial pulse, both in terms of education and resources, is necessary. There needs to be, in a sense, a large-scale national campaign directed not only to Congress and to the public at large, but to the science establishment itself. But, it is equally important to note that any successful funding program must have a built-in mechanism for automatic, continuous, ongoing support.

The famous question about the purpose of basic research was compellingly answered by another question: "what is the use of a baby?." I think the analogy can be applied in this infrastructure area, too. It is not very wise to starve a child for 5 or 10 years and then suddenly put him in a gourmet restaurant, expect him to choose sensibly, gorge himself, and then survive for another 5 or 10 years. Stability is one of the key things that we have to address in this context of research and infrastructure if we are going to maintain the momentum and the vitality of the research enterprise.

Statement by
Peter Likins
President
Lehigh University

I suppose my role here this morning is to provide the perspective of the university president. You will notice, however, that I am president of only one university. There are a lot of them out there, and they are all different, many quite different in character from my own. So I wouldn't presume to present more than my own perspective.

It is the nature of our system, this pluralistic system of which we hear so much, that no university president is qualified to speak for all others. I do have some history, however, that might help give you a sense of where my biases come from. I am at Lehigh University, which is not among those that have benefitted in recent years from direct Congressional appropriation. Columbia University is one such beneficiary, however, and I was an unprotesting provost when Columbia made the decision to go to the lobbyists. Lehigh and Columbia are both private institutions, but my 9 years in those two institutions just balance out the 12 years I spent at UCLA, a decidedly public institution.

So my biases in some sense might be assumed to cancel each other. This digression into my own background is important, because my basic message today is that we are looking not at a single such facilities problem, but at a whole nest of problems associated with academic research facilities, a whole set of problems that are diverse because the institutions in which they reside are diverse. It follows surely that there is not going to be a single solution. We have to be looking for a system of solutions, a set of responses that will enable us -- as an unofficial and disorganized system of higher education and research in this society -- to wrestle with these problems and to come to grips with them.

I am not going to dwell in my brief opening remarks here on the problems themselves. I think there is a general understanding that we have a set of grave problems or we wouldn't all be here today. I must say though, parenthetically, that as I listen I am increasingly persuaded that we do not all have the same understanding of the problems. We do need to get more deeply into defining the problems before we can come forth with comprehensive solutions.

I would like to focus on a few specific alternatives that have been proposed as solutions, if only to make the point that is my theme: that no one of these will work by itself, but all of them functioning together in a complementary way might enable us to get through this period of difficulty.

First, I am a member of the White House Science Council panel that Bernadine Healy has been deeply involved with and that Jay Keyworth put together. David Packard chairs the panel with Alan Bromley, and we have been struggling for over a year with a set of questions, including these questions of university research facilities. This particular panel has come to focus on what you might think of as the indirect cost recovery (ICR) strategy. That strategy says we simply borrow the money, hoping to take advantage of some of the cheap money alternatives currently available in tax-exempt financing for fiscally sound private institutions and for public institutions. We borrow the money, and then we retire the debt with the ICR funds, combining a claim for the interest with a more realistic use allowance than the 2 percent currently available to us. We talk about 5 percent as a representative number.

All this has to be understood in a context in which we are trying to deal with the administrative sector of the ICR as well, in order to defuse some of the tensions that we all know are associated with indirect cost recovery. I won't go into that, because this is not the meeting in which to do so, but you understand the basic strategy.

Of course, it succeeds nationally only if there is a very substantial increase in the total amount of funds appropriated for university research, because this strategy would clearly increase ICR rates in those institutions committed to paying for new facilities in this way.

But even if that premise is accepted and there is a substantial increase in funding in order to accomplish the facility development objective, we still have to recognize that this ICR strategy has a major deficiency. Namely, it is feasible only in those institutions that already have a very well-developed base of Federal research funding. It wouldn't work, for example, at Lehigh. We can't pay for a $10-12-15 million building by taking out a 20-year bond issue and paying 8 percent, and even with a 5 percent use allowance, spreading those costs over 20 years. To do so would boost our indirect cost rate from 65 to 90 percent in one year, and that, I think, is by consensus an unacceptable elevation. The problem is, we don't have the denominator. We don't have the base in research volume.

But at Columbia, where there is an order of magnitude more money coming in for research, it is, I think, feasible to finance a $10 million capital investment with this strategy. So it is a strategy that has some merit and, incidentally, it wouldn't matter much whether it was indirect cost recovery that was paying for these building costs or direct costs or rental charges of the kind that Bob Sproull has proposed. In any event, the money basically comes directly out of the research contracts of the principal investigators in the institution, and the strategy works only if there is a very substantial dollar volume.

Now, there is another alternative, a major initiative represented by H.R. 2823, the University Research Facilities Revitalization Act of 1985, which I think most of you are familiar with. This bill would mandate continuing support for university research facilities from each of the six major research-funding Federal agencies. The bill has a number of interesting features, including one that would reserve 15 percent of the facilities capital improvement funds for academic institutions that are not among the 100 best-funded research institutions in the country.

A major difference in the two strategies, the ICR strategy and that associated with the bill I have just described, is the different roles played by the peer review process in determining just where the money goes. Obviously, with the ICR strategy we are using existing peer review procedures, according to which individual proposals are reviewed to determine where the money goes. If you were to think in terms of a facilities fund of the sort described in the proposed bill, then still I think you would rely substantially on peer review, probably panel peer review, but you could charge the review committees much more broadly. It wouldn't be simply the merit of individual proposals being considered; moreover, you could have higher-level review based on considerations that go beyond the technical evaluations by the peer committee. So it is still peer review. It is still comparative analysis, but it is different and more general in character.

It would seem that in both of the strategies I have just described, approximately 15 percent of the money would go to institutions below the top 100 in terms of Federal funding level.

The third major alternative I want to talk about is direct Congressional action on specific university proposals. To a certain degree, this is going to go on in any event because of the nature of our political system. But the absence of any kind of peer review makes this process a very inefficient one, a very clumsy one, a very poor way to allocate our resources. To some degree, though, we have to recognize that if we don't have either of the other mechanisms in place, this option will be exercised, because individual institutions perceive what they propose to do as good: good for themselves, and in many instances, good for the nation as a whole. So they will pursue this path if it is the only game in town. In fact, I think finally most of us will end up playing this game if other options are not developed. Currently this is often the only way to meet the legitimate interests of individual institutions. Unfortunately, it is a process that doesn't serve the nation very well, but this is the option of default, and it seems to stand today as a de facto national policy.

If we want to reverse these trends and change these policies, then we'd better get beyond just talking about it rather soon.

Statement by
Buddy MacKay
Member, U.S. Congress

There are 15 specific examples over the past three years of universities bypassing the peer review system, and the materials provided for this meeting do a very good job in making the point that in each case the funding came out of somebody else's potential research project. Let me update that.

I am on leave of absence from the Science and Technology Committee, and I serve as a member of the Budget Committee. I represent in the Budget Committee the needs and views of the scientific community. So I have watched with somewhat more than normal amazement what is going on this year.

Let me just report on two bills. The first is the Energy and Water Development Appropriations Act, generally known as the "pork barrel" bill. It contains the Department of Energy budget. It also contains this year 64 new water projects, and it is handled by the father of the Tennessee-Tombigbee water project, Congressman Tom Bevill, a widely respected person. He is not known, however, for representing peer review in university research.

Let me tell you some of the miraculous things that have happened, and you see if you can square these up with what we are talking about this morning. First, the University of Alabama at Huntsville is authorized a U.S. Army Corps of Engineers learning facility, to be owned and maintained by the University of Alabama. The next item: $8 million to the University of Alabama for an energy and mineral research center. Next item: $6 million for Atlanta University, Center for Science and Technology. Then $6 million for Tulane University, Center for Energy and Biomedical Technology, and $5 million for Brown University, demonstration center for information technologies. That is in the House.

That was last week. Not all of you are laughing, because some of you had something to do with some of this.

Now, in the Senate, let me report on the FY 1985 Supplemental Appropriations bill. Now, you may be able to see some parallels, not between America's priorities and the flow of money, but rather between congressional seniority and the flow of money. Listen to this one: University of Utah -- this is a Hatch amendment, $2 million, a center to study the health effects of new energy technologies. Next, St. George, Utah -- we can't even figure out whether this is going to a university or not -- $3 million, a center for cancer research. That is a Hatch amendment. Next item, University of Kansas, $200,000 to improve the interface between agriculture and satellite data. That is a Dole amendment. We are not sure if the decimal place is wrong; it seems strange. Next item, Mississippi State University, $3.5 million, a center for aquaculture research; that is Senator Cochran's floor amendment.

Those are in just two bills, and the best is yet to come, because we have abandoned the budget process under which any member of the House would have a point of order against any item related to the expenditure of money that has not been through the committee process. The interesting thing about all of these is, they haven't been through any committee. In some cases they provide funding for programs that have not yet been authorized.

When we abandon the budget process, we end up with what is called a Continuing Resolution, which characteristically is adopted around the 23rd of December and is known as the Christmas tree. So hang on, and you will see what we finally do.

It seems to me there is a lesson in this. We are clearly in the grips of the second law of aerodynamics: you can't push an object that is moving faster than you are.

That is the news. Let me talk about what I would call the editorial page. It seems to me the universities in America are starting to mutiny. They see Federal research policy as becalmed for the last decade and now foundering, and they are striking out on their own. The irony is that the mutiny is gaining momentum just as the promised land is coming into view. The promised land, by my simple analogy, is an emerging public consensus that we are inescapably part of a single international economy, and that more emphasis on research innovation is essential to our survival. I saw that piece written by Lester Thurow, who says we must compete under new rules in order to survive. I saw the one by Robert Reich, who writes that the raw material of the future is the human mind. I saw one by Peter Drucker, who states that the way to win in the emerging international competition is to be the most efficient at recruiting, motivating, educating, and focusing our supply of intellectual power.

Part of the promised land is that, for the first time, the private sector clearly understands that its interests are the same as yours. At the very least, the private sector is supporting you. In some ways they are ahead of you. In many cases, I see the private sector moving strongly to support the case for enhanced university-based basic research.

The problem is that the private sector is not going to wait around for the scientific community and the university community to get their acts together. If they see you as incapable of dealing with this mutiny, if they see this as moving irreversibly to the politics of the pork barrel, they will not be your supporters any longer; they will become your potential competitors.

I point out to you that last year we changed the antitrust law that prohibited joint ventures in research and development. This means that you now have the semi-conductor industry as a potential competitor for basic research funding. In her statement, Dr. Healy pointed out the unique nature of basic research in America. It really is unique. We are the only country in the world that does it this way, and there could be a case made that if we are not going to follow rational priorities in funding basic research, it might be better to do it like everyone else. My warning for those of you who think that it is clever to abandon the ship and start your own effort is this: remember there are some people out there who are very experienced, very clever, with much better clout than any of us in this room might have, in terms of reaching the levers of power.

So what should you do? I would like to make several suggestions. First, I think the scientific community and the university community have got to get further out front than thus far we have been willing to do. We are clearly in a time of budget constraints. I have looked at your workshops, and it seems to me there should be a workshop titled however you want to title it, but it should concentrate on enhancing your part of the pie when the total pie is not expanding but contracting, because that is the challenge that we face.

Unless we are able to expand this nation's commitment to basic research, you are inherently going to be at each other's throats. I think if you go through a day and a half and don't deal with that, then you should plan another conference next year to talk about how much worse the problem has gotten, because that is what is going to happen.

You've got to redefine what you are selling. The people I was quoting -- Thurow, Reich, Drucker -- they are not writing for the academic community; they are writing to the private sector. They are selling a message for you that the private sector is prepared to buy, and that is: the raw material of the future is the human mind, and if this country is going to be competitive, we must start putting more of an investment into basic research. Now, that is what you've got to sell, and it seems to me you've got to organize yourselves to do a more persuasive sales job.

You can't sell peer review per se. I have sat on committees where you have tried. Let me tell you something: "peer review" is not a self-defining term, and when you finish trying to sell that concept to a group of people who have all kinds of other priorities on their minds, it is not coming across. You've got to sell peer review for some other reason, and that other reason has to be something that they and their constituents can get excited about, and I think the answer is competitiveness. Basic research is necessary to bring America back to the point where we would all like to feel it once had been. You've got to make common cause with your allies, and some of your allies are people that you don't normally associate with. You've got to talk to people in the private sector. You've got to talk to the people in state government. They've got to be your allies in this. You've also got to talk to the people in the public interest community.

One of my crusades that is very analogous to this one is the crusade against "pork barrel" water projects. There we have an alliance between the National Taxpayer's Union and the environmental lobbyists. People like the National Taxpayer's Union would probably be on your side, if they understood what is involved in peer review. It would help your effort to have a responsible conservative group out front, pointing out the abuses every time some university tries to end-run the system. You've got to start thinking differently about this.

I support the Fuqua bill. I think it is very good legislation. I want to suggest to you that it needs to be a great deal stronger. Somewhere we've got to spell out in lay terms what we are trying to accomplish and why, and we've got to have standards that are tight enough so they are enforceable, and I think the Fuqua bill ought to be viewed as a beginning point.

My last comment: we've got to have in this country aggressive support for something like the science policy project, which is now going on in the Science and Technology Committee. People are trying to ask basic questions in this country. What are we trying to accomplish? What should our priorities be? Clearly we don't have enough money to do everything; somehow or other, we've got to spell out aggressively why good science policy and peer review are important to the future of this country, and we've got to be prepared to defend that. We've got to be prepared to defend it not in academic language, but in the sawmill language that my constituents and I speak.

Statement by
Alvin Trivelpiece
Director, Office of Energy Research
U.S. Department of Energy (DoE)

This morning Roland Schmitt talked about the need for trying to address solutions and not just ventilating the problem. I attended the session of Working Group Six,and I have some bad news, Roland: I think the ventilation is still going to go on for a while.

For some time, many of us have tried to persuade the Congress through fundraisers or letter-writing campaigns or testifying that science and technology are important ingredients in the nation's economic health and well being over the long term. The members of Congress have finally taken us somewhat more seriously than they used to, and they are trying to improve conditions with respect to their own districts or their own states by passing laws that would make certain facilities come into being. And we don't like it. Why?

Well, in some sense, what Congressman MacKay was saying is that they are not playing by our rules, they are playing by their rules, and as elected officials they have both the right and the power to pass certain laws and funding bills. Their doing so makes it incumbent on some of us who have a sworn obligation to uphold the law to carry out the actions required by the law.

In our concern we try to suggest that peer review might be a fairer approach to the allocation of resources for certain types of facilities, but to some Congressional members, what that means is that Harvard and MIT get all the money. I understand that some limited number of faculty members actually believe that is okay. To some scientists, peer review (or merit review, as Dale Corson would like to condition us into using) really means retaining the status quo that is going to exclude new ideas, and there is some problem in that.

I have been engaged in some of the trench warfare regarding this issue for the last few years, and I have noticed that there is a tendency to try to define it in certain stark black-and-white terms. But, like many hot issues, this is one that has many levels of gray in it. I would like to devote a few minutes to talking about the way I see it, from more of a gray-scale perspective.

From DoE's perspective, the Catholic University Vitreous State Laboratory was not something related to any of our technical programs. We have no interest in it whatsoever. It simply is a program that language in an appropriations report required us to fund in the form of a grant. There was no peer review issue. Many people have said, "Well, why didn't you engage in some form of peer review and do something about that issue?" There was no peer review possible. The only thing we were obliged to do was certify that the architectural and engineering plans met certain standards that DoE is in a position to review and so certify.

I don't think that many people fully appreciate the change that has taken place in the last couple of years with regard to laws that the Congress itself has passed. For example, when the Vitreous State Laboratory came into existence as a project, it was made possible through some rather obscure and disconnected language in the appropriations report. The subsequent year, there were certain changes in the Competition in Contracting Act that then required that such matters not simply be in report language, but be the subject of a law. Then last year the Competition in Contracting Act was made even stiffer. As I understand it now, an appropriations bill is essentially going to have to say, "...the Competition in Contracting Act of 1984 nothwithstanding, the Department of Energy is directed to do thus and so..." So it has become progressively harder for the Congress itself to do the kinds of things that were referred to here, but that has not changed whether or not they are going to do them.

A table prepared for the conference states that the money for Catholic University came from the $26 million originally requested by the Department for the Center for Advanced Materials at Berkeley. This is really not so, and if it came from anywhere, $2 million of it came from the $6 million that had been allocated for university research instrumentation, which was a third of that money. That was very serious, because there was a real cause-and-effect relationship, where you could find where it came from and where it went to by direction.

Columbia University has also been mentioned frequently. Columbia was also a building project, and so it is perhaps a bit arrogant on the part of Columbia to call it the National Center for Chemistry Research. Whatever, the funding for it came from the same place, namely, the university instrumentation program.

It was part of the general Energy and Water Bill appropriation. It is indistinguishable; that is, you can't say what the cause-and-effect relationship is.

I have had it suggested to me at various times that the overall appropriation was in fact greater as a result of Columbia University's efforts than it would otherwise have been, because of the Congressional goodwill that was established by that project being in there. Now, I doubt that, but I can't prove it either way, and I think attempts to prove it are very difficult because it really is an indistinguishable issue.

But those two projects we regard as one category, namely they are things for which we have no programmatic interest. They are the same for us as if they were a freeway, a river or harbor, or whatever. They are in the ordinary sense, then, pork barrel projects.

Florida State University has come in for a certain amount of bashing, but I don't put it in the same category. It is at another level on a scale of gray. We did have some minor disagreements with the committee in the course of trying to develop what it was we were going to do with Florida State. But in the end, it turned out that we do have a mutual interest in having this facility come into existence, and we have now a vested interest in seeing that it is excellent, that it is first class. We will work with them to make sure that it comes out that way.

In the process, good, bad, or indifferent, a large number of university computer scientists are going to have access to a first-class computer facility a year or two years earlier than otherwise. Now is that good or bad? I don't know. You can decide that for yourself, but in the end, we decided to work with them and make sure it was going to work.

Congressman MacKay just referenced Atlanta University. Now, Atlanta University indeed is in there as a Congressional add-on, but in fact, it was in my department's original request to OMB this year. It was something we planned to do. We had reviewed it, and we supported it as part of the President's program to help advance Historically Black Colleges and Universities. So it was in there and then taken out by the "no-new-start" requirement that came about as a result of the budget restrictions.

In trying to tailor my remarks to what my colleagues have said, one of the things that does occur to me is that the problem really is more political than technical, and we tend to be collectively, as scientists, nonpolitical by nature. Stop and think for a moment that maybe one of the problems is that we don't have a political action committee. There is no such thing as a science, engineering, and technology political action committee. We don't have the means to deal with the members of Congress on terms that they are normally accustomed to, namely, how would we express our collective pleasure and displeasure. We are supported in our research activities as a result of their goodwill, and they are reasonably generous.

How many of you have been to fundraisers? How many of you have tried directly within your state apparatus to get people elected? And how successful at it have you been? I think we need to work in that arena collectively more than we have been prepared to in the past or normally would have the stomach to want to do. But it is part and parcel of the process, and I don't think we want to meet here again next year only to bemoan the fact that things have become substantially worse, and we have no lever to influence the situation.

From that point of view, the important question is how do we go about expanding the pie? Political pressure applied collectively to expand the pie would probably be better than engaging in a debate on how the pie is to be divided. From DoE's point of view, I thought Bob Sproull's paper was first class. The remarks made about trying to handle this from a point of view of cost recovery and so on make the most sense from our agency's perspective.

There have been several circumstances in which we have in fact funded buildings in the academic enterprise in just that manner. Where it was of interest to us to do so, we have paid an extra use charge over a period of time that was appropriate to full cost recovery of the building. We have the machinery to do it, and we can do it. However, we find an impediment in the academic institution's reluctance to take on multiple overhead rates or use charges in ways that would make it easy to do.

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SUMMARY OF PLENARY DISCUSSION*

The plenary discussion responded to the panel debate and to the reports of the task group leaders. It focused on the nature and level of the need for academic research facilities; possible sources, mechanisms, and levels of funding; and the role and definition of the review process for facility funding.

Federal Grant Program for Facilities:

The presence of Congressman Don Fuqua, Chairman of the House Science and Technology Committee and principal sponsor of H.R. 2823, The University Research Facilities Revitalization Act, provided a special focus for the discussion.

Mr. Fuqua noted that he regarded H.R. #2823 as a point of departure and a consensus-building device. He urged the mobilization of grass-roots support to make members of Congress aware of the importance of the facilities problem, but cautioned against taking a great deal of time to get the bill enacted. The task of having the legislation reported out by the four committees in the House of Representatives to which the bill had been referred would in itself be a time-consuming problem.

Mr. Fuqua expressed the sentiments of the majority of those present when he stated that the need for facilities modernization is serious and calls for immediate attention. However, not all attendees shared this view. Dr. Kreon Cyros (MIT), for example, expressed the feeling of several people present that not all agree that Mr. Fuqua's bill is necessary,particularly if no new money is forthcoming. Dr. Cyros' observation that many universities are more likely to spend available funds on repairs than on new construction found partial reinforcement in Dr. Massy's comment that many individual researchers do not consider facilities to be an urgent priority. Dr. Cyros suggested that except for those few persons responsible for the broad needs of the research system, there is no sizable group of people who regard facilities as an urgent priority.

How to estimate the extent and seriousness of the need for facilities modernization was a question that cropped up repeatedly in the course of the discussion. Views ranged considerably. Dr. Stelson, for example, acknowledged the need for better information but suggested that it should be easy to document that some institutions are turning away research grants because they do not have appropriate facilities for handling them. President Robert Bock (University of Wisconsin) remarked that the need varies by discipline.

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*Prepared by Marta Cehelsky/NSF Staff

Dr. Barbara Hansen (University of Southern Illinois) and Ron Douglas (Stony Brook), were among several individuals who cautioned that support for a Federal facilities program would be contingent on the availability of additional funding. They indicated that the majority of principal investigators would not concur in according facilities the highest priority, and would not be eager to allocate a portion of support currently going directly for research to facilities renovation. Mr. Fuqua responded that while we must continue to hope that budgets will be increased in the future, facilities are an integral part of doing research and must be supported along with other research priorities.

Some conference participants were uncertain as to whether enactment of the bill would result automatically in set-asides from the R&D budgets of the agencies affected, regardless of whether additional money is appropriated for this purpose. Ezra Heitowit, Staff Director of the House Subcommittee on Science, Research and Technology, clarified that the set-aside would not be triggered unless the additional initial appropriation was approved by Congress. However, statements by Congressmen Fuqua and Buddy McKay and from the House Appropriations Committee member, Matt McHugh, emphasized that it would be inadvisable to count on new money for a facilities program in the current budgetary climate. "...Under the budget," Mr. Fuqua stressed, "and the problems of the real world we live in today, there is no way that we are going to get additional money for any program right now."

Several participants raised questions about specific aspects of the funding mechanism proposed in the bill. Drs. Stelson and Bloustein noted that the bill does not allow for inflationary adjustment. Ezra Heitowit observed that the specific provisions of the bill were open to discussion, but he noted that the intent of the bill was not to preserve the existing budget structure, but to change it by building facilities funding into budgeting and planning activities.

Referring to a point raised earlier by Dr. Bloustein, Mr. Fuqua stated that the notion of introducing some flexibility in the bill's requirement for matching funds had merit. He strongly disagreed, however, with the suggestion offered by Paul Martin from Harvard University that the bill's provision for setting aside up to 10 percent of an agency's R&D budget for facilities be made "permissive" rather than obligatory. There would be no assurance, he said, that the money would be spent as intended. Agencies currently have the authority to fund facilities on a permissive basis; the problem is that they are not doing so.

University of Wisconsin President Bock and Orville Bentley from the U.S. Department of Agriculture applauded the clarification of agency authority to support facility renovation. Dr. Bock indicated that the absence of a clearly stated authorization applicable to all the concerned agencies has been a problem.

Alternative Financing Arrangements:

Dr. Massy, alluding to the absence of new Federal money for facilities, raised the issue of improving access to private markets, not only through debt financing but also by sale-leaseback. Noting that present tax law makes it difficult for nonprofit organizations to take advantage of this procedure, he pointed out that the mechanism would be effective in spreading the cost of facilities over time.

Mr. Fuqua agreed that the absence of additional money to fund facilities raises a challenge to states and other entitities to come up with funds to contribute to the renovation of facilities. However, he took strong exception to the notion of relying on alternative mechanisms such as indirect cost formulas, debt financing, or establishment of a nonprofit corporation to support financing. It is not credit that the institutions need, Fuqua said, it is money to address an immediate problem. However, he agreed with Dr. Massy's urging that better use be made of private markets and with his observation that existing tax laws are a stumbling block. Congressman Fuqua noted, however, that occasionally there are means of getting around restrictions posed by state laws, and cited recent experience in Florida, where revenue bonds were made available to circumvent the state-level constitutional prohibition against bond issues not approved by public referendum.

Dr. Bloustein also expressed reservations about reliance on indirect cost reimbursement. For state university systems, he observed, indirect cost reimbursement is not an effective mechanism for supporting facilities renovation. The 50 states treat indirect cost recovery differently, and even within the same state, various institutions can be treated differently with respect to their indirect cost recovery by the state treasurer. Another disadvantage of indirect cost recovery he noted, is that it does not have the matching inducement of the grant program being proposed in Mr. Fuqua's bill

Dr. Carey inquired as to whether the state initiatives task group considered the possibility of combining various initiatives by the states through an interstate-compact device as a means of rationalizing the distribution of and access to facilities. Dr. Wise, who had chaired the task group, said the group had not considered this mechanism but that in his view the procedure is perfectly legitimate.

Stuart Rice (University of Chicago and National Science Board) asked Mr. Fuqua about the feasibility of reallocating funds within the Federal R&D budget to generate additional resources for funding research facilities. Former Rice University President Norman Hackerman raised the question of reallocating funds from development projects to start a facilities program while continuing to develop other long-term solutions.

In response, Mr. Fuqua stressed that such suggestions are not likely to make it past the Office of Management and Budget, and that it is important to focus on what is feasible. In addition, he indicated, placing the funding burden on the development budget would not be a workable political solution; there is considerably more public and political support for development, the practical impact of which is more obvious, than there is for basic research, the importance of which is not as well understood.

There was also some discussion of the role and responsibility of the Department of Defense in funding facilities. Dr. Pickar stated that his task group concurred that the deterioration of research facilities involves the national defense, and that DoD has the responsibility, opportunity, and resources to make an impact. Although there was no concrete discussion of how this might be accomplished, there was at least a clear feeling that it would be useful to limit the impact of the Mansfield Amendment, which has served to inhibit DoD-supported research at universities.

Mark Crawford from Science magazine questioned the appropriateness of looking to the Defense Department to finance the construction of facilities and asked whether the nation could afford to have a program supported in this manner take on a defense orientation. Mr. Fuqua commented that the only "taint" in such circumstances is "t'aint enough"; where the money comes from is immaterial.

Comprehensive Merit Evaluation:

The subject of merit review stimulated considerable discussion. Before opening the discussion to the floor, Dr. Corson invited Mr. Fuqua to comment. Mr. Fuqua indicated that merit review was discussed a great deal in the course

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of preparing the facilities bill and that decisions respecting facilities should be based on merit. However, he stated, the facilities program is intended to be a national program and should, accordingly, serve the national interest. This requires taking other factors into account in the decisionmaking process. He pointed out that the charter of the National Science Foundation requires the Foundation to promote excellence, but to do so with the additional objective of promoting it throughout the country. Decisions on facilities, he stated, must involve judgments of a broad range of people, and not just disciplinary experts.

Mr. Fuqua also indicated that the facilities bill does not prescribe a rigid procedure for awarding facilities grants, and leaves it to the individual agencies to apply their own review methods. Maryanne Bach, a member of the House Science and Technology Committee minority staff, pointed out that the facilities bill also recognizes the need to provide special consideration for "have not" schools, and sets aside 15 percent of the funding for academic institutions that have not been the primary beneficiaries of Federal support.

At Dr. Corson's request, Dr. Wells, the Chairman of the Task Group on Merit Review, described the minority view within this group with regard to the concept of comprehensive merit review. Inviting others to supplement his account, he indicated that the primary objection to the term was that acknowledging a change and providing a new name to a process which is long established and rooted in tradition (that is, bringing in a "new term of art") would give a different connotation to the decisionmaking process. Said Dr. Wells, "It would connote that we are introducing into the scientific and technical merit review process factors which have not traditionally been part of that scientific or technical review."

Dr. Carey, who had taken the lead in arguing the minority position, emphasized the importance of recognizing the serious budgetary constraints affecting funding decisions. "We are," he stated, "in a rationing situation." The National Science Board, the Board of the AAAS, the Council of the AAAS, boards of a number of major scientific societies, as well as the President of the National Academy of Sciences, he noted, have come out strongly in opposition to the "fence jumping" by universities, which by-passes the quality control mechanisms that have operated for a very long time. Past facility-building programs, Dr. Carey pointed out, occurred in periods not limited by today's serious budget constraints. At this point in time, discretionary resources are not in evidence.

A major problem with the term "comprehensive merit review," he continued, is that it establishes no boundary conditions.

The decision to fund a particular facility at a particular location could respond to any number of considerations that conceivably fall under its rubric. Ultimately, the "introduction of a new term in competition with 'peer review' has the effect of muddying the water with imprecise guidelines, with decision factors that are not weighted and that are open ended." As a result, Dr. Carey continued,we risk resigning ourselves to the likelihood that there will be no national policy to reinvest in infrastructure, and the spead of undisciplined competition among individuals and institutions. What is implied is more extensive politicization of the process.

Dr. John Silber (Boston University) differed strongly with Dr. Carey. With respect to the question of universities by-passing the merit review system to secure Congressional funding for facilities, he observed, "...there was a thorough and ...definitive discussion to show that there was no such standard peer review process in existence for the determination of facilities, and consequently, nobody had by-passed anything." Furthermore, he indicated, the claim that programs funded in such a manner threaten science in general was unsubstantiated.

Dr. Silber characterized the concept of peer review as expressed by Dr. Carey as "a mythical notion...some form of immaculate conception" in which precise and objective judgments are made on the merits of a proposal. In fact, he stated, the process is considerably more complex than that and includes questions of economic development, location, and geography. The value of the new terminology that has been proposed is that it acknowledges complexity where complexity exists. Questioned by Dr. Sessions as to whether he feels that universities should begin using the political process, Dr. Silber responded that the most successful universities have been using the political process "with an expertise and a seriousness I strongly applaud." Far from objecting to this, he believes that the success of the top 20 universities in this regard should be emulated.

Dr. Bloustein, reformulating the middle ground between these two views, objected to Dr. Silber's characterization of the supporters of peer review. It is clear that the scientific evaluation procedure is not immaculate; the issue is, however, whether there is a process common to all projects that are funded. Likewise, the role of considerations other than merit is not at issue; the issue is whether those other considerations should displace prior scientific consideration What is troublesome about the by-pass incidents, he stated, is that the process of scientific review did not take place before the political process went to work.

Joe Morone (General Electric Corporation) questioned how competing criteria such as excellence and equity might be reconciled in the process of deciding on grants for facilities. The choices in the future may not, he suggested, be among equally excellent schools that might be more or less needy. Compromises may be required with respect to one or the other of the criteria when need is pitted against quality. Dr. Wells acknowledged the difficulty and complexity of the issue and suggested that the decision-making process will necessarily remain messy.

Summation:

In the final segment of the conference, Dr. Corson invited Drs. Healy and Schmitt to present their impressions of the most important features of the discussion that took place that day and to define the next steps that must be taken.

Dr. Healy, remarking on the difficulty of summarizing the varied content of the meeting, proposed to comment on three selected aspects of the facilities renovation issue. First, she observed, one of the most important facts confronted in the course of the discussion was the notion that limitations on funding must be acknowledged in addressing the facilities problem. It is most unlikely, she concurred, that substantial quantities of new resources will become available. But she cautioned against unnecessary pessimism. The limitation on Federal resources does not imply the total absence of funding, and it is important to recall that since 1980 there has been an increase of more than 20 percent in real dollars for university-based research. This, she suggested, is indicative of a privileged status for research and a recognition of the importance of science and technology to the nation as a whole.

Simultaneously, she stated, we must recognize that very little of this money has gone to the pressing needs of maintaining the research infrastructure. Given the well-recognized short-term budgetary constraints, we must consider strategies that will begin to address this need. One such strategy worthy of consideration is the possibility of reallocating money to the support of the research infrastructure from other purposes. The Administration has already acted to increase basic research support dramatically and to reduce support for development programs, of which the synfuels development program is one example.

Futher thought might be given to the allocation of the nonmilitary R&D budget, she added. Of the $20 billion represented by that budget, between $5 and $6 billion are spent on university research. Most of the civilian R&D budget is spent on the non-DoD Federal laboratories which, as indicated by the Packard report, are having problems regarding the quality of their work and the value of our investment in them. A shift of $1 billion "in the right direction" could represent a substantial investment in infrastructure. But shifting funds within the civilian research and development budget will admittedly be more difficult than suggesting lower levels of military spending.

The second issue Dr. Healy singled out was the question of comprehensive merit evaluation. She observed that some of the constraints on dollars, combined with concerns about opportunity for a wide range of colleges and universities, have been reflected inappropriately in total by-pass of scientific merit review through Congressional actions. It is important to note, she indicated, that in both the content and tone of the discussion that had taken place, there was "an endorsement of a system of orderly review in the context of strong, scientific evaluation which nevertheless does take into account political, social, and geographic considerations, but in a setting away from the immediate political environment, away from the Congressional pressures."

The third point raised by Dr. Healy focused on how money might be obtained to address the facilities problem when it is clear that not much is available. Easy credit, in her view, is not the answer. There is no indication that most universities are being turned down by banks. The real issue is access to dollars. In confronting this problem, Dr. Healy noted, we must recognize that there has been a "maldistribution" of research dollars: direct research costs have been supported at a reasonable rate, reimbursement for administrative costs has grown disproportionately, and infrastructure needs have been neglected.

The indirect cost recovery formula should be evaluated with the aim of providing for more realistic recovery rates for depreciation, use allowances, and equipment. Not only should one question the 50-year amortization periods for buildings, but one also must question whether the money being recovered, even if it were to remain at 2 percent, is in fact being directed to support infrastructure. Along with providing for more realistic rates of depreciation, mechanisms assuring the application of such reimbursements to infrastructure support should be developed. In addition, reimbursement for administrative costs should be made more realistic to provide some latitude for improving the recovery of expenditures on facilities.

Dr. Healy concluded by stressing that universities must become more active and put pressure on Federal agencies, on the Administration, and on Congress, and scrutinize their own actions to determine whether they are in fact doing all that is possible to support research infrastructure. The role of pressure will be increasingly important. The priority of science is often not accepted in government circles and "the scientific community sells itself more like a group of welfare mothers than a vital and essential part of the fabric of our society....And welfare mothers are more effective political petitioners than scientists." Science is a long-term investment in the economic success of the nation. That perspective, implies a partnership involving the Congress, executive branch, universities and research institutes, states and localities, industry, and the public at large.

Dr. Schmitt opened his concluding remarks with a reminder of Samuel Johnson's well-known observation that "...there is nothing like the prospect of a hanging to clarify the mind." Given the gravity of the facilities problem, he said, the maxim may explain why this group was assembled to examine the issue.

Rather than review the remarks and presentations which have become familiar to all the conference participants, Dr. Schmitt addressed a few basic points. One was to examine why the facilities modernization problem has grown so large. For this, he suggested, there are two explanations. One is that there has been consistent underinvestment by the academic community in infrastructure for more than a decade. Second, research and development is becoming more capital intensive than in the past.

Whether or not additional resources are available, money must be found to address the problem. Congressman MacKay's suggestion to look elsewhere within the Federal budget should be taken seriously, Dr. Schmitt observed. "Tapping into" a certain percentage of the total R&D budget was suggested by several people, including Dr. Healy, and could be given further consideration. But there also needs to be a better job done of presenting the case for supporting scientific research on the basis of national interest. From the industrial view, given the importance of academic research to the strength of the U.S., this should be easy to do.

With respect to alternative approaches, Dr. Schmitt indicated a difference of opinion with Dr. Healy. Mr. Fuqua's facilities bill, he indicated, "is an excellent instrument and it has been presented for triggering the discussion...." However, it would be highly desirable to complement the consideration of the facilities bill with serious consideration of Dr. Clapp's proposal for a nonprofit corporation along the lines of "Fannie Mae" or a similar mechanism. It would be helpful to have in place a process which would not require another Fuqua bill in 10 years, but attend to the problem in perpetuity.

With respect to the revenue stream used to pay off bonds, the resources for payback come from overhead pools, and it must be left to the academic community, which is diversified in its mode of operation, flexibility, requirements imposed by state governments, and its consequent needs.

Many of the problems associated with the merit review issue, Dr. Schmitt stated, could be resolved by targeting two central objectives: first, "...preserving the excellence that we have, whether you regard it as inequitable distribution or not." Equally important is an effort "to create new excellence based on the energy, on the vision, the initiatives, the talents that are out there. There is no reason to believe that people, individuals, institutions with those characteristics are maldistributed geographically or by any other criterion."

Dr. Corson completed the overview and summation by addressing additional elements that had been stressed in the course of the day's discussion. One, he pointed out, is that national interest underlies all that we do in scientific research. "Science is public property now. It is big. There are lots of dollars. It is related to economic welfare, and it is going to be looked at that way by the public and the Congress." That requires that the scientific community do a better job of "selling its product," as suggested by Representative MacKay.

Another leitmotif of the conference, Dr. Corson indicated, is that the magnitude of the problem and the limitation on resources make reliance on partnerships absolutely essential. There must be an effort to build better support for science and to educate the general public. This effort is already under way, and ties between universities and industries are growning.

Finally, Dr. Corson stated, the idea of support for scientific research as an investment rather than a procurement has come up several times. This is an important perspective for supporting the research enterprise.

PART III: BACKGROUND DOCUMENTS

FACT SHEET

H.R. 2823
UNIVERSITY RESEARCH FACILITIES REVITALIZATION ACT OF 1985

Introduced by Rep. Don Fuqua (D-FL)
Chairman of the Committee on Science and Technology
U.S. House of Representatives
on June 20, 1985

- This legislation would reestablish an important federal investment in the physical infrastructure for research, which is so vital to our national science and engineering base. Several federal R&D agencies established programs for the construction of academic research facilities after the Soviet launch of Sputnik in 1958. Such programs, although they were uncoordinated, helped build U.S. research capacity in the 1960's, but by the early 1970's the programs were terminated.

- H.R. 2823 would authorize the creation of university and college research laboratory modernization programs in the six leading federal R&D agencies: the National Science Foundation (NSF), the Department of Health and Human Services (HHS), the Department of Defense (DOD), the Department of Energy (DOE), the National Aeronautics and Space Administration (NASA), and the Department of Agriculture (USDA).

- The legislation would authorize start-up funds for the laboratory modernization programs, and would require structural changes in the R&D agency budgets that provide for a steady, systematic investment in university research facility renewal that is now absent from the budget process. This investment would be indexed to the annual level of federally-supported R&D performed at our universities and colleges.

- The federal share of the ten-year program to be roughly $5 billion, which would leverage another $5 billion in non-federal funds, for a total of $10 billion.

- The National Science Foundation would play a special coordinating role. Beginning in fiscal year 1986, NSF would be authorized to carry out periodic assessments of university and college research facility needs, and to report on the implementation of the laboratory modernization programs.

- For the first year of the ten-year facility modernization program, fiscal year 1987, H.R. 2823 would authorize "start-up" funds for six agency programs. The amount of each agency authorization would be roughly proportional to that agency's current obligations for R&D to universities and colleges.

- The total FY 1987 authorization is $470 million, which is somewhat less than 10 percent of the total of all federal obligations for R&D to higher education institutions. (In FY 1983 the latter total was $5 billion.)

- The FY 1987 authorization is divided among the six leading federal R&D agencies as follows:
  NSF: $100 million
  HHS: $200 million
  DOD: $100 million
  DOE: $25 million
  NASA: $20 million
  USDA: $25 million

- For the second through the tenth year of the program, FY 1988 - FY 1996, each of the six agencies would be required to reserve at least 10 percent of their R&D obligations to universities and colleges for their facility modernization programs, which at that point would form part of the R&D base of each agency.

- H.R. 2823 contains a critical provision to protect the base of university R&D funding, so that the 10 percent formula for laboratory modernization not be an undue tax on funding for research grants. This provision prevents the facility programs, once established, from growing dollarwise any faster than the R&D base during years of increased R&D funding. The bill also takes into account the unpleasant possibility of decreased R&D funding. During such years the modernization program formula would be reduced below 10 percent, and would, in fact, become zero in the event R&D funding was cut 10 percent or more.

- The bill also contains a key provision which assures that the facility programs do not favor the big, well-established, research universities over the smaller or newly-emerging, higher education institutions. This provision requires that at least 15 percent of the amounts that are reserved (10 percent of academic R&D obligations) for the facility programs would be available to those universities and colleges below the first 100 institutions in overall federal R&D funding. Indeed, these institutions, taken together, receive 15 percent of federal R&D funding to all universities and colleges, and this provision assures that they receive at least a proportional share of facility funding.

- H.R. 2823 calls for a six agency program, and is within the jurisdiction of four Committees in the House of Representatives: the Committees on Agriculture, Armed Services, Energy and Commerce, and Science and Technology. Chairman Fuqua has today written to the Chairmen of the other three Committees requesting their co-sponsorship of the bill and urging their leadership in further refining provisions.

- Chairman Fuqua intends this legislation to be a vehicle to develop consensus within the Congress, within the Executive Branch, and within the academic community that it so directly affects. He plans to have the Committee on Science and Technology convene a comprehensive set of hearings on the bill to receive the views of all concerned.

99TH CONGRESS
1ST SESSION

H. R. 2823

To assist in revitalizing the Nation's academic research programs by requiring specified Federal agencies to reserve a portion of their research and development funds for the replacement or modernization of laboratories and other research facilities at universities and colleges.

IN THE HOUSE OF REPRESENTATIVES

JUNE 20, 1985

Mr. FUQUA introduced the following bill; which was referred jointly to the Committees on Science and Technology, Energy and Commerce, Armed Services, and Agriculture

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A BILL

To assist in revitalizing the Nation's academic research programs by requiring specified Federal agencies to reserve a portion of their research and development funds for the replacement or modernization of laboratories and other research facilities at universities and colleges.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

SECTION 1. This Act may be cited as the "University Research Facilities Revitalization Act of 1985".

FINDINGS

SEC. 2. The Congress finds that—

(1) the fundamental research and related education programs supported by the Federal Government and conducted by the Nation's universities and colleges are essential to our national security, and to our health, economic welfare, and general well-being;

(2) many national research and related education programs conducted by universities and colleges are now hindered by obsolete research buildings and equipment, and many institutions lack sufficient resources to replace or modernize their laboratories;

(3) the Nation's capacity to conduct high-quality research and education programs and to maintain its competitive position at the forefront of modern science, engineering, and technology is threatened by this research capital deficit, which poses serious and adverse consequences to our future national security, health, welfare, and ability to compete in the international marketplace;

(4) a national effort to spur reinvestment in research facilities is needed, and national, State, and local policies and cooperative programs are required that will yield maximum return on the investment of scarce national resources and sustain a commitment to excellence in research and education;

(5) Federal agencies, as part of their missions and in partnership with the States, industry, and universities and colleges, must repair the historic linkages between Federal investment in academic research and training and investment in the research capital base by reinvesting in the capital facilities which modern research and education programs require;

(6) each of the major Federal research and development agencies must participate in a sustained government-wide program to revitalize our academic research facilities by making capital investments in the fields of science and engineering essential to its mission; and

(7) the Congress and the Executive branch require adequate and timely information concerning the condition and future needs of university and college research laboratories and equipment.

PURPOSE; ESTABLISHMENT OF UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAMS

SEC. 3. (a) It is the purpose of this Act to assist in revitalizing the Nation's academic research programs through capital investments in laboratories and other research facilities at universities and colleges.

(b) To carry out this purpose, each of the major Federal research and development agencies shall establish and carry out a new university research laboratory modernization program, under which an amount equal to a specified portion of the funds available to the agency involved for research and development awards to institutions of higher education (as provided in titles I through VI of this Act) will be reserved for the replacement or modernization of such institutions' obsolete laboratories and other research facilities.

(c) The university research laboratory modernization program established by a major Federal research and development agency pursuant to subsection (b) shall be carried out, through projects which involve the replacement or modernization of specific research facilities at the universities and colleges involved and for which funds are awarded in response to specific proposals submitted by such universities and colleges, in accordance with regulations prescribed by the head of such agency with the objective of carrying out the purpose of this Act. The regulations so prescribed shall contain such terms, conditions, and guidelines as may be necessary in the light of that objective, but shall in any event provide that funds to carry out the program (as made available to the agency pursuant to title I through VI of this Act) will be awarded on a competitive basis, and that the funds so awarded to any university or college will be in an amount not exceeding 50 percent of the cost of the replacement or modernization involved (with the funds required to meet the remainder of such cost being provided by the institution involved or from other non-Federal public or private sources).

(d) Criteria for the award of funds to any institution for a project under a university research laboratory modernization program shall include—

(1) the quality of the research and training to be carried out in the facility or facilities involved;

(2) the congruence of the institution's research activities with the future research mission of the agency making the award; and

(3) the contribution which the project will make toward meeting national, regional, and State research and related training needs.

(e) As used in this Act, the term "major Federal research and development agency" means—

(1) the National Science Foundation;

(2) the Department of Health and Human Services;

(3) the Department of Defense;

(4) the Department of Energy;

(5) the National Aeronautics and Space Administration; and

(6) the Department of Agriculture.

TITLE I—IDENTIFICATION AND ASSESSMENT OF UNIVERSITY AND COLLEGE RESEARCH FACILITY NEEDS; FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE NATIONAL SCIENCE FOUNDATION

IDENTIFICATION AND ASSESSMENT OF UNIVERSITY AND COLLEGE RESEARCH FACILITY NEEDS

SEC. 101. (a) The National Science Foundation is authorized to design, establish, and maintain a data collection and analysis capability in the Foundation for the purpose of identifying and assessing the research facilities needs of universities and colleges. For this purpose the needs of universities and colleges for construction and modernization of research laboratories, including fixed equipment and major research equipment, shall be documented by major field of science and engineering; and expenditures by universities and colleges for the construction and modernization of research facilities, the sources of funds, and other appropriate data shall be collected and analyzed.

(b) Every two years the Foundation, in conjunction with other appropriate Federal agencies, shall conduct the surveys which are necessary to identify and assess the research facilities needs of universities and colleges as required under subsection (a), and shall report the results to the Congress. The first such report shall be submitted to the Congress no later than September 1, 1986.

(c) When conducting the surveys required by subsection (b) the Foundation shall also collect and assess data on the implementation of the university research laboratory modernization programs being carried out (by the Foundation and by the other major Federal research and development agencies) under the succeeding provisions of this Act; and when reporting the results of such surveys to the Congress it shall also report to the Congress with respect to the implementation of those programs.

FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE NATIONAL SCIENCE FOUNDATION

SEC. 102. (a) There is hereby authorized to be appropriated to the National Science Foundation for the fiscal year 1987, for the specific purpose of implementing and carrying out the new university research laboratory modernization program established by the Foundation pursuant to section 3(b) of this Act, the sum of $100,000,000.

(b)(1) Of the total sum appropriated to the National Science Foundation for each of the fiscal years 1988 through 1996 and available for obligation by the Foundation for research or research and development awards to universities and colleges, an amount at least equal to the minimum amount determined under paragraph (2) shall be reserved for purposes of this Act and used only to carry out the Foundation's university research laboratory modernization program as so established. The use of the reserved amount to carry out that program may be accomplished either as a part of awards made to the universities and colleges involved for activities carried out under the authority of other laws or through separate awards made for purposes of this Act; and in either case such amount shall be so used only on the basis of proposals submitted by such universities and colleges as described in section 3(c).

(2) The minimum amount to be reserved for purposes of this Act and used as described in paragraph (1) in any fiscal year, out of the total sum appropriated to the Foundation for that year and available for obligation by the Foundation for research or research and development awards to universities and colleges, shall be the lesser of—

(A) 10 percent of such total sum; and

(B) the amount by which—

(i) the full amount of such total sum, plus the amount that was reserved for purposes of this Act and used as described in paragraph (1) in the preceding fiscal year, exceeds

(ii) the full amount of the corresponding total sum (appropriated to the Foundation and available for obligation by the Foundation for research or research and development awards to universities and colleges) for the preceding fiscal year.

(3) At least 15 percent of the amount which is required to be reserved for purposes of this Act and used to carry out the Foundation's university research laboratory modernization program in any fiscal year under paragraph (1) shall be available only for awards to universities and colleges that received less than $10,000,000 in total Federal obligations for research and development (including obligations for the university research laboratory modernization program) in each of the two preceding fiscal years.

TITLE II—FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE DEPARTMENT OF HEALTH AND HUMAN SERVICES

FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE DEPARTMENT OF HEALTH AND HUMAN SERVICES

SEC. 201. (a) There is hereby authorized to be appropriated to the Department of Health and Human Services for the fiscal year 1987, for the specific purpose of implementing and carrying out the new university research laboratory modernization program established by the Department pursuant to section 3(b) of this Act, the sum of $200,000,000.

(b)(1) Of the total sum appropriated to the Department of Health and Human Services for each of the fiscal years 1988 through 1996 and available for obligation by the Department for research or research and development awards to universities and colleges, an amount at least equal to the minimum amount determined under paragraph (2) shall be reserved for purposes of this Act and used only to carry out the Department's university research laboratory modernization program as so established. The use of the reserved amount to carry out that program may be accomplished either as a part of awards made to the universities and colleges involved for activities carried out under the authority of other laws or through separate awards made for purposes of this Act; and in either case such amount shall be so used only on the basis of proposals submitted by such universities and colleges as described in section 3(c).

(2) The minimum amount to be reserved for purposes of this Act and used as described in paragraph (1) in any fiscal year, out of the total sum appropriated to the Department for that year and available for obligation by the Department for research or research and development awards to universities and colleges, shall be the lesser of—

(A) 10 percent of such total sum; and

(B) the amount by which—

(i) the full amount of such total sum, plus the amount that was reserved for purposes of this Act and used as described in paragraph (1) in the preceding fiscal year, exceeds

(ii) the full amount of the corresponding total sum (appropriated to the Department and available for obligation by the Department for research or research and development awards to universities and colleges) for the preceding fiscal year.

(3) At least 15 percent of the amount which is required to be reserved for purposes of this Act and used to carry out the Department's university research laboratory modernization program in any fiscal year under paragraph (1) shall be available only for awards to universities and colleges that received less than $5,000,000 in total Federal obligations for research and development (including obligations for the university research laboratory modernization program) in each of the two preceding fiscal years.

TITLE III—FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE DEPARTMENT OF DEFENSE

FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE DEPARTMENT OF DEFENSE

SEC. 301. (a) There is hereby authorized to be appropriated to the Department of Defense for the fiscal year 1987, for the specific purpose of implementing and carrying out the new university research laboratory modernization program established by the Department pursuant to section 3(b) of this Act, the sum of $100,000,000.

(b)(1) Of the total sum appropriated to the Department of Defense for each of the fiscal years 1988 through 1996 and available for obligation by the Department for research or research and development awards to universities and colleges, an amount at least equal to the minimum amount determined under paragraph (2) shall be reserved for purposes of this Act and used only to carry out the Department's university research laboratory modernization program as so established. The use of the reserved amount to carry out that program may be accomplished either as a part of awards made to the universities and colleges involved for activities carried out under the authority of other laws or through separate awards made for purposes of this Act; and in either case such amount shall be so used only on the basis of proposals submitted by such universities and colleges as described in section 3(c).

(2) The minimum amount to be reserved for purposes of this Act and used as described in paragraph (1) in any fiscal year, out of the total sum appropriated to the Department for that year and available for obligation by the Department for research or research and development awards to universities and colleges, shall be the lesser of—

(A) 10 percent of such total sum; and

(B) the amount by which—

(i) the full amount of such total sum, plus the amount that was reserved for purposes of this Act and used as described in paragraph (1) in the preceding fiscal year, exceeds

(ii) the full amount of the corresponding total sum (appropriated to the Department and available for obligation by the Department for research or research and development awards to universities and colleges) for the preceding fiscal year.

(3) At least 15 percent of the amount which is required to be reserved for purposes of this Act and used to carry out the Department's university research laboratory modernization program in any fiscal year under paragraph (1) shall be

available only for awards to universities and colleges that received less than $5,000,000 in total Federal obligations for research and development (including obligations for the university research laboratory modernization program) in each of the two preceding fiscal years.

TITLE IV—FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE DEPARTMENT OF ENERGY

FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE DEPARTMENT OF ENERGY

SEC. 401. (a) There is hereby authorized to be appropriated to the Department of Energy for the fiscal year 1987, for the specific purpose of implementing and carrying out the new university research laboratory modernization program established by the Department pursuant to section 3(b) of this Act, the sum of $25,000,000.

(b)(1) Of the total sum appropriated to the Department of Energy for each of the fiscal years 1988 through 1996 and available for obligation by the Department for research or research and development awards to universities and colleges, an amount at least equal to the minimum amount determined under paragraph (2) shall be reserved for purposes of this Act and used only to carry out the Department's university research laboratory modernization program as so established. The use of the reserved amount to carry out that program may be accomplished either as a part of awards made to the universities and colleges involved for activities carried out under the authority of other laws or through separate awards made for purposes of this Act; and in either case such amount shall be so used only on the basis of proposals submitted by such universities and colleges as described in section 3(c).

(2) The minimum amount to be reserved for purposes of this Act and used as described in paragraph (1) in any fiscal year, out of the total sum appropriated to the Department for that year and available for obligation by the Department for research or research and development awards to universities and colleges, shall be the lesser of—

(A) 10 percent of such total sum; and

(B) the amount by which—

(i) the full amount of such total sum, plus the amount that was reserved for purposes of this Act and used as described in paragraph (1) in the preceding fiscal year, exceeds

(ii) the full amount of the corresponding total sum (appropriated to the Department and available for obligation by the Department for research or research and development awards to universities and colleges) for the preceding fiscal year.

(3) At least 15 percent of the amount which is required to be reserved for purposes of this Act and used to carry out the Department's university research laboratory modernization program in any fiscal year under paragraph (1) shall be available only for awards to universities and colleges that received less than $2,000,000 in total Federal obligations for research and development (including obligations for the university research laboratory modernization program) in each of the two preceding fiscal years.

TITLE V—FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SEC. 501. (a) There is hereby authorized to be appropriated to the National Aeronautics and Space Administration for the fiscal year 1987, for the specific purpose of implementing and carrying out the new university research laboratory modernization program established by the Administration pursuant to section 3(b) of this Act, the sum of $20,000,000.

(b)(1) Of the total sum appropriated to the National Aeronautics and Space Administration for each of the fiscal years

1988 through 1996 and available for obligation by the Administration for research or research and development awards to universities and colleges, an amount at least equal to the minimum amount determined under paragraph (2) shall be reserved for purposes of this Act and used only to carry out the Administration's university research laboratory modernization program as so established. The use of the reserved amount to carry out that program may be accomplished either as a part of awards made to the universities and colleges involved for activities carried out under the authority of other laws or through separate awards made for purposes of this Act; and in either case such amount shall be so used only on the basis of proposals submitted by such universities and colleges as described in section 3(c).

(2) The minimum amount to be reserved for purposes of this Act and used as described in paragraph (1) in any fiscal year, out of the total sum appropriated to the Administration for that year and available for obligation by the Administration for research or research and development awards to universities and colleges, shall be the lesser of—

(A) 10 percent of such total sum; and

(B) the amount by which—

(i) the full amount of such total sum, plus the amount that was reserved for purposes of this Act and used as described in paragraph (1) in the preceding fiscal year, exceeds

(ii) the full amount of the corresponding total sum (appropriated to the Administration and available for obligation by the Administration for research or research and development awards to universities and colleges) for the preceding fiscal year.

(3) At least 15 percent of the amount which is required to be reserved for purposes of this Act and used to carry out the Administration's university research laboratory modernization program in any fiscal year under paragraph (1) shall be available only for awards to universities and colleges that received less than $2,000,000 in total Federal obligations for research and development (including obligations for the university research laboratory modernization program) in each of the two preceding fiscal years.

TITLE VI—FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE DEPARTMENT OF AGRICULTURE

FUNDING FOR THE UNIVERSITY RESEARCH LABORATORY MODERNIZATION PROGRAM IN THE DEPARTMENT OF AGRICULTURE

SEC. 601. (a) There is hereby authorized to be appropriated to the Department of Agriculture for the fiscal year 1987, for the specific purpose of implementing and carrying out the new university research laboratory modernization program established by the Department pursuant to section 3(b) of this Act, the sum of $25,000,000.

(b)(1) Of the total sum appropriated to the Department of Agriculture for each of the fiscal years 1988 through 1996 and available for obligation by the Department for research or research and development awards to universities and colleges, an amount at least equal to the minimum amount determined under paragraph (2) shall be reserved for purposes of this Act and used only to carry out the Department's university research laboratory modernization program as so established. The use of the reserved amount to carry out that program may be accomplished either as a part of awards made to the universities and colleges involved for activities carried out under the authority of other laws or through separate awards made for purposes of this Act; and in either case such amount shall be so used only on the basis of proposals submitted by such universities and colleges as described in section 3(c).

(2) The minimum amount to be reserved for purposes of this Act and used as described in paragraph (1) in any fiscal year, out of the total sum appropriated to the Department for that year and available for obligation by the Department for research or research and development awards to universities and colleges, shall be the lesser of—

(A) 10 percent of such total sum; and

(B) the amount by which—

(i) the full amount of such total sum, plus the amount that was reserved for purposes of this Act and used as described in paragraph (1) in the preceding fiscal year, exceeds

(ii) the full amount of the corresponding total sum (appropriated to the Department and available for obligation by the Department for research or research and development awards to universities and colleges) for the preceding fiscal year.

(3) At least 15 percent of the amount which is required to be reserved for purposes of this Act and used to carry out the Department's university research laboratory modernization program in any fiscal year under paragraph (1) shall be

available only for awards to universities and colleges that received less than $2,000,000 in total Federal obligations for research and development (including obligations for the university research laboratory modernization program) in each of the two preceding fiscal years.

○

Tax-Exempt Financing for Research Facilities

David Clapp

(June 1985)

Proposal

To establish an independent, nonprofit corporation that would receive funding from Federal appropriations as well as business and public contributions for the purpose of providing guarantees, grants, loans, and other financial assistance to nonprofit independent or state-related educational and/or scientific research projects. The corporation would assist institutions primarily by providing credit support or leveraging for capital borrowing programs in the tax-exempt bond market.

DISCUSSION

Background

Both independent and state-related institutions generally have legal access to the tax-exempt capital markets at the present time. Most state universities can issue tax-exempt bonds (i.e., bonds the interest on which is exempt from Federal income tax) directly as state government instrumentalities. An independent institution can achieve a generally similar result through the auspices of an agency, created at the state or local level, which issues tax-exempt bonds and uses the proceeds to finance capital projects subject only to certain limitations imposed by state law. Medical schools and hospitals have widely used this type of financing for health care projects as well as higher education institutions. However, in these cases, theinstitution must rely on its own credit rating. The proposal in this paper is intended to remove that requirement.

This paper is concerned with institutions that are exempt from Federal income tax as charitable or educational organizations or as state universities. Other entities, such as proprietary health care corporations or private research companies, may engage in similar projects but have a different financial status because of their different legal status.

In recent years investment bankers have relied increasingly on the financial techniques of *leveraging* and *credit support* to enhance the utility of tax-exempt financing to qualifying institutions. These techniques work briefly as follows:

Leveraging: Leveraging refers generally to the practice of adding borrowed funds to funds on hand, in order to "leverage" the funds on hand by enabling the institutions to finance bigger projects. Leveraging is inherent, though not always apparent, in virtually every capital project financing in the tax-exempt market. When an institution uses agency financing for a *project, it is in essence using the borrowing to leverage its own endowment and cash flow. Leverage also occurs in the form of a direct grant or low interest loan provided by a governmental agency in tandem with the tax-exempt borrowing. The Federal Government program for Urban Development Action Grants is an important example, in the area of inner-city renovation, though soon it may be only of historical interest in view of the Administration's proposal to eliminate this program. Agencies themselves occasionally provide leverage to their own borrowers, generally by making grants or loans at a lower interest rate than the interest rate payable by the agency on its own bonds, and subsidizing the difference from agency capital.*

Credit Support: *Interest rates in the tax-exempt market depend on the credit strength of the borrowing entity in addition to numerous other factors. In this respect the tax-exempt market is similar to the general taxable market, though interest rates in the tax-exempt market are generally a few percentage points below the rates obtainable by a comparable credit in the taxable market, because of the value of the tax exemption to investors. In the tax-exempt market as it exists today, entities offering credit support include insurance companies offering "bond insurance" policies, commercial banks* offering letters of credit, and insurance funds offered by states to their agencies. Bond insurers undertake to pay the principal and interest on the insured bonds if for any reason there is default by the bond issuer. Some bond insurers operate, or "specialize," only in specific, specialized market sectors, such as health care. In view of this fact there may be a potential for ready market acceptance of an insurance program that would concentrate on financings for scientific research as an instance of a specialized market sector. Credit support programs represent a highly efficient form of leveraging in that the asset dollars of the credit provider--such as a bond insurer--will support a vastly greater dollar amount of project financing.

How the Corporation Would Work

Introdction: Formation of a nonprofit corporation is a simple procedure generally requiring little more than filing the articles of incorporation or corporate charter, signed by the individuals serving as the initial trustees, with the state government of the state chosen for incorporation. The laws of most states are similar in dealing with nonprofit corporations and allow the corporation's bylaws to make decisions about the size and composition of the board of trustees, the frequency and *procedure for meetings, and so on. Frequently, a nonprofit corporation will supplement its formal board of trustees with one or more advisory boards composed of persons of distinction in its area. Use of an advisory board might be particularly appropriate in the present case due to the technical nature of the projects the corporation would be considering.*

Incorporation under Federal Law is also possible, but would require specific Federal authorization. Several existing programs operate under Federal charters but have evolved to situations where the ties to the Federal Government seem primarily historical or nominal, such as the Federal National Mortgage Association.

The need for funding of reasearch facilities presents the challenge of asking for money for activities that do not have a large natural constituency of voters and whose benefits to society may be perceived by some as being less immediate than other competing demands. A great deal of study and consultation would be necessary to determine the likelihood of a substantial federal appropriation for a project of this type in the present federal budgetary climate or in any climate reasonably foreseeable. Potentially the strongest argument in favor of funding for this corporation would be the leveraging it would offer in that each dollar of appropriation should lead to many more dollars of actual expenditure on projects.

Charitable foundations tend to prefer making gifts for specific projects as distinguished from ongoing programs such as discussed here for the corporation. In addition, private corporations tend to sponsor research useful to their own product development rather than general purposes. In addition, funds from these sources are inadequate when compared to the national need. Thus the opportunities for capital funding from the private sector may be limited.

Mechanics: In general, the new corporation would be operated using the following mechanics. Congress would appropriate an amount, say $500 million, on a one time, no recourse basis. The money would be invested to yield the highest prudent current return. Institutions wishing to construct research facilities would apply to the corporation for assistance. An advisory board to the corporation would determine the worthiness of the project. The staff of the corporation would examine and pass upon the financial soundness of the applicant and construction cost estimates of the project.

Once the project is approved by both the advisory board and the corporation staff, the applicant institution would enter into a loan agreement with the corporation. The loan agreement would pledge certain assets of the institution to the corporation and contain certain covenants as to performance. The principal covenants would be, from the Corporation, the agreement to lend funds which, together with other available funds, will be used to construct the project, and from the applicant institution, the promise to repay the loan over an agreed time period (say 10-30 years) and the agreement to use the loan to construct the project and operate it as a research facility (this latter term would be defined).

From time to time the corporation would combine groups of projects into appropriate gross amounts (say $100 million) and then sell its tax-exempt bonds to provide loan funds. The bonds would be secured by and payable from (i) moneys due under the loan agreements, (ii) the invested $500 million trust fund and (iii) a letter of credit or other financial guaranty in an amount to assure the highest possible credit ratings on the tax exempt debt.

The institution's interest rate would be computed to be the corporation's bond rate less an amount of subsidy running from the corporation to the institution. The subsidy, which could be determined either uniformly or according to relative need, would take the form of a grant to the institution and would be derived from income earned on the $500 million trust fund. Since the $500 million principal is not expected to be diminished the leverage provided by this money is, in effect, used over and over.

If an institution defaults on its loan repayments, the corporation will reserve the right to enter upon and sell the research facility and to substitute another project into the loan package financed by a particular corporation bond issue. However, the institution's obligations to the corporation under its loan agreement would not be relieved.

The amoritization schedule for loan agreements would be tailored to match the specific project. For instance, a project for which the borrowed funds would generally be used for a building (as opposed to equipment) would likely amortize over the useful life of the building. If a project were mostly equipment, amortization might be shorter, reflecting the shorter useful life.

Observations: *The advisory board* could and should operate independently. This would promote fair treatment when the merits of research projects are being discussed and decided upon. This board would determine the material required from institutions making applications for assistance. In addition, the board would make site visits, post-completion inspections, etc.

The *corporation staff* would examine all the finances and determine the need for the projects and the ability to repay loans. This "underwriting" function can be performed in a manner which will lend credibility and stability to the overall program.

The *$500 Million Trust Fund*, and the loan-bond structure as a whole, should not inhibit or discourage corporate and foundation gifts and grants to projects. On the contrary, since bond funds could be used in much the same way as matching funds are in other programs, giving should actually increase--thereby increasing the ability to find 100% funding for projects on a combined basis. Also, loans could be repaid from gifts received over the usual 3 - 5 year pledge periods, but construction of projects will not be slowed by insufficient available funds.

Corporation tax exempt bond issues will be nationally popular and will attract investors. The nature of the program, with a high national profile, together with the loan agreements and credit support, will present triple A security for bond purchasers. The fact that the corporation will issue bonds several times a year will create a wide and continuing market for its issues. The result would be a vastly increased financial capability for the construction of research facilities.

State Law Authorization for Projects

State laws providing for agency financing are not uniform in their definitions of facilities qualifying for financing. The following is an example of relatively broad language that could apply to a research facility at a college or university.

> "Eligible facility" means any site, structure, or equipment suitable for use in academic, research, and cultural activities at a college, including but not limited to, classrooms, laboratories, libraries, research facilities, academic buildings, housing units, dining facilities, administration buildings, health care facilities, parking, maintenance, storage and utility facilities, and all the

facilities, equipment materials and furnishings necessary and usually attendant thereto: Provided, That "eligible facility" shall not include any facility used or to be used for sectarian instruction or study, or as a place for devotional activities or religious worship.

This language authorizes financing research facilities of a college or university. It would be less likely for state law to authorize financing of research facilities at independent institutions which did not have an educational program in the normal sense of a student body, faculty, classrooms, and so on.

Federal Tax Authorization

The program of the corporation as described above would not require any amendment to the provisions of the Internal Revenue Code pertaining to tax-exempt financing. However, the Administration has recommended amendments to eliminate the ability of authorities to issue tax-exempt bonds for the benefit of private educational or health care institutions. If the Congress accepts the Administration's recommendation but wishes to preserve the program described here for the corporation, *Congress could enact a special provision dealing with the matter.*

All of the foregoing is intentionally brief and certain details as to legality and mechanics are not included. This paper does, however, provide a basis for discussion and uses concepts and ideas which have been used in other situations in several states across the country.

Excerpt from:

H.R. 3700, 99th Congress

"An Act to amend and extend the
Higher Education Act of 1965"

As passed by the House of
Representatives, December 1985

"PART E—COLLEGE CONSTRUCTION LOAN INSURANCE ASSOCIATION

"SEC. 751. CONGRESSIONAL DECLARATION OF PURPOSE; DEFINITION; INCORPORATION.

"(a) PURPOSE.—The Congress hereby declares that it is the purpose of this part to authorize participation of the United States Government and the Student Loan Marketing Association in a private, for profit corporation to be known as the College Construction Loan Insurance Association (hereinafter referred to as the 'Corporation') which will, directly or indirectly, alone or in collaboration with others—

"(1) guarantee, insure and reinsure bonds, debentures, notes, evidences of debt, loans and interests therein, the proceeds of which are substantially to be used for an education facilities purpose;

"(2) guarantee and insure leases of personal, real or mixed property substantially to be used for an education facilities purpose; and

"(3) issue letters of credit and undertake obligations and commitments as the Corporation shall deem appropriate for the purpose of increasing the availability of funds for educational facilities and equipment.

"(b) STATUS AS NON-GOVERNMENTAL ENTITY.—The Corporation shall not be an agency, instrumentality or establishment of the United States Government and shall not be a

'Government corporation' nor a 'Government controlled corporation' as defined in section 103 of title 5, United States Code.

"(c) CORPORATE POWERS AND LIMITATIONS.—The Corporation shall be subject to the provisions of this part and, to the extent not inconsistent with this part, to the District of Columbia Business Corporation Act. It shall have the powers conferred upon a corporation by the District of Columbia Business Corporation Act as from time to time in effect in order to conduct its corporate affairs and to carry out its purposes and activities incidental thereto.

"(d) DEFINITION OF EDUCATION FACILITIES PURPOSE.—As used in this section, an 'education facilities purpose' includes any activity relating to the construction, reconstruction, renovation, acquisition or purchase of (1) education, training or research facilities or housing for students, faculty or staff, (2) any underlying real property or any interest therein, (3) furniture, fixtures and equipment to be used in connection with any education or training facility or housing for students, faculty or staff, and (4) instructional equipment and research instrumentation including site preparation for such equipment and instrumentation.

"SEC. 752. PROCESS OF ORGANIZATION.

"The Secretary of the Treasury, the Secretary of Education and the Student Loan Marketing Association shall each appoint two persons to be incorporators of the Corporation. If either the Secretary of the Treasury or the Secretary of Education fail to appoint incorporators within 90 days after the date of enactment of the Higher Education Amendments of 1985, the Student Loan Marketing Association shall have the authority to name the incorporators which have not been so appointed. The incorporators so appointed shall each sign the articles of incorporation and shall serve as the initial Board of Directors until the members of the first regular Board of Directors shall have been appointed and elected. Such incorporators shall take whatever actions are necessary or appropriate to establish the Corporation, including the filing of articles of incorporation.

"SEC. 753. OPERATION AND ELECTION OF BOARD OF DIRECTORS.

"(a) IN GENERAL.—The Corporation shall have a Board of Directors which shall consist of eleven members, of whom one shall be elected annually by the Board to serve as chairman. Directors shall serve for terms of one year or until their successors have been appointed and qualified, and any member so appointed to fill a vacancy shall be appointed only for the unexpired term of the Director whom he succeeds. Two Directors shall be appointed by the Secretary of the Treasury; two Directors shall be appointed by the Secretary of Education; three Directors shall be appointed by the Student Loan Marketing Association; and the remaining four Directors shall be elected by the holders of the Corporation's voting common stock at least one of whom shall be a college or university administrator.

"(b) CUMULATIVE VOTING.—The articles of incorporation of the Corporation shall provide for cumulative voting under section 27(d) of the District of Columbia Business Corporation Act (D.C. Code, sec. 29-327(d)).

"SEC. 754. INITIAL CAPITAL.

"(a) AUTHORITY TO ISSUE COMMON STOCK.—The Corporation shall issue shares of voting common stock of no par value at such time within six months of its incorporation as shall be designated by the initial Board of Directors, for an aggregate consideration of not more than $30,000,000. During each of the four years thereafter, the Corporation shall issue additional voting common stock at such date or dates in each year determined by the Board for an aggregate consideration of not more than $55,000,000 in each year. Such shares shall be issued and sold to the Secretary of Education and the Student Loan Marketing Association in the ratio of five-to-one as provided in subsections (b) and (c) of this section.

"(b) SUBSCRIPTION BY SECRETARY OF EDUCATION.—The Secretary of Education is authorized and directed to subscribe to and purchase, in each of the five years referred to in subsection (a) of this section, voting common stock of the Corporation having an aggregate purchase price of not more than $25,000,000, subject to availability of appropriations.

"(c) SUBSCRIPTION BY ASSOCIATION.—The Student Loan Marketing Association is authorized to subscribe to and purchase in each of the five years referred to in subsection (a) of this section voting common stock of the Corporation having an aggregate purchase price of not more than $5,000,000.

"(d) ANNUAL ISSUANCE.—The Corporation is authorized to offer for subscription and purchase to the general public in each of the five years referred to in subsection (a) of this section voting common stock having an aggregate purchase price of not more than $25,000,000. Not less than $10,000,000 of such stock shall be set aside for purchase by institutions of higher education prior to being offered to the general public.

"SEC. 755. ISSUE OF NONVOTING STOCK AND DEBT TO THE PUBLIC.

"The Corporation may issue without limitation as to amount or restriction as to ownership such nonvoting common, preferred and preference stock, debt and such other securities and obligations, in such amounts, at such times and having such terms and conditions as may be deemed necessary or appropriate by its Board of Directors.

"(d) TERMINATION OF OWNERSHIP RESTRICTIONS AND STATE LAW EXEMPTIONS AFTER COMPLETE BUY-OUT.—If the Student Loan Marketing Association acquires all of the issued and outstanding voting common stock of the Corporation owned by the Secretary of Education, section 757 shall be of no further force or effect as from the first day of the calendar year commencing after such acquisition is completed.

"(e) RIGHT OF FIRST REFUSAL TO ASSOCIATION.—Until such time as the Student Loan Marketing Association acquires all of the voting common stock owned by the Secretary, the Student Loan Marketing Association shall have the right to purchase all, or any lesser portion it shall select, of each of the issues of equity securities or other securities convertible into equity of the Corporation as the Corporation may issue from time to time, on the same terms and conditions as such securities are to be offered to other persons.

"(f) AUTHORITY OF ASSOCIATION WITH RESPECT TO CORPORATION.—The Student Loan Marketing Association is authorized and empowered to purchase stock and to carry out such other activities as are necessary and appropriate for carrying out the Association's obligations and responsibilities with respect to the Corporation. The Student Loan Marketing Association is also authorized to enter into such other transactions with the Corporation, including the acquisition of securities and obligations of the Corporation referred to in this section and sections 754 and 755, and arrangements for the provision of management and other services to the Corporation, as shall be approved by the Student Loan Marketing Association and the Corporation.

"SEC. 759. USE OF STOCK SALE PROCEEDS.

"The proceeds received by the Secretary of Education upon the sale of any of its shares of the Corporation to the Student Loan Marketing Association shall be paid into a fund established on behalf of the Secretary of Education and administered by the Corporation. The purpose of the fund shall be to provide guarantees and insurance on behalf of those institutions of higher education which do not otherwise qualify for programs conducted by the Corporation because of an inability to comply with financial criteria required by the Corporation.

"SEC. 760. AUDITS; REPORTS TO THE PRESIDENT AND THE CONGRESS.

"(a) The books of account of the Corporation shall be maintained in accordance with generally accepted accounting principles and shall be subject to an annual audit by an independent public accountant.

"(b) REPORTS.—The Corporation shall transmit to the President and the Congress, annually and at such other times as it deems desirable, a report of its operations and activities under this part, which annual report shall include a copy of the Corporation's financial statements and the opinion with respect thereto prepared by the independent public accountant reviewing such statements and a copy of any report made on an audit conducted under subsection (a).

Discussion Paper

Robert L. Sproull
President Emeritus, University of Rochester
Member, Government-University-Industry Research Roundtable Council

EXPLICIT RENT CHARGES: ONE APPROACH TO MEETING FACILITY NEEDS

One component of indirect costs or pooled costs in federal R&D grants and contracts to universities is a use allowance or depreciation on buildings in which the research is carried out. The standard allowable use charge is 2 percent per year. A university may include an alternative depreciation rate if it is fully documented. It also is possible to include within pooled costs, with permission of the agency sponsoring the research, the interest on loans taken by the university to construct the building in which the research is being carried out.

Various proposals have been offered for modifying these procedures and for standardizing them across all federal agencies as a way to enhance the nation's capability for maintaining and building state-of-the-art academic research facilities. The approach proposed here is to make the charge for rent of research space an explicit component of federal R&D contracts and grants to universities.

The basic idea of the proposal below is to segregate a substantial portion of the pooled costs of research into a package that is a less controversial and more defensible cost allocation, and an allocation that can be compared with other universities and with industry. Although arguments and dissatisfactions will persist, the intent is to confine them to a smaller part of the whole, and thereby reduce the overall dissatisfaction.

Direct Charge for Rent

The basic approach is to assemble the costs that would appropriately be counted as part of rent of research space and deal separately with the "basket" as rent-per-square-foot of space used on the federally supported project. The claim is that rent is easily understandable and readily comparable, and therefore less controversy could be anticipated in this part of the pooled costs.

The elements in the rent calculation would include: 1) building depreciation and obsolescence, 2) routine maintenance, 3) security, 4) grounds care for grounds immediately attached to the building, 5) parking lot costs for spaces required by people associated with the building space, and 6) heat, power, light, "pure waters" charges.

Item (1) above would be large and the most difficult to calculate initially and to agree upon. The history at each university of renovations and of modifications to accommodate new programs, would form the basis of the calculation. This could be done on a university-wide basis but for two categories of space, laboratory and office. It would be helpful if the dollars-per-square-foot introduced into the calculation could remain for (say) five years with an agreed annual escalation.

The other items would present fewer problems. In many institutions, insufficient metering-by-building of steam, water, and electricity exists to make accurate calculations. But energy conservation is stimulating more and more metering, and university-averages could probably be divided into laboratory and office rates without much trouble.

As part of the negotiations leading to the agreed rent-per-square-foot, comparisons would be made with laboratory and office space of comparable quality in the same geographic area. These comparisons would be an important part of the defense of the charged rate.

In addition to rent, the other elements of the indirect cost pool would remain, but it would be well to make some changes in these as part of the process of using rent as a major element. "Central Administration" would probably remain about as is. "Research Grants and Contracts Administration," now 100% in the pool, would be put in at some percentage (85%? 90%?) less than 100%. The purpose of this change, which would of course cost the university, is to acknowledge the "bid and proposal" nature of some of this activity and to provide an obvious and evident incentive for the university to keep these costs down.

"Departmental Administration" has been a major bone of contention, and universities usually settle for far less than they think is appropriate. One approach might be to fix the contribution to the pool at x% per full-time-equivalent faculty member. That is, if the sponsored research faculty spent the equivalent of (say) 12.5 FTE's on this research in a department of 25 people, half of the department office costs would go into the pool. This approach probably substantially *under*states the fair charge to the government, but could be easily defended. Another approach might be to add y$ per FTE (on research) faculty member, where y would be the same country-wide. Since universities usually *discount* their fair "take" in this area anyway, it might be better to lose full repayment obviously by formula (and publicly claim this as cost sharing) than to lose it (as at present) in complicated, unpublicized negotiations.

Library, student affairs, and other small items would be left unchanged.

Although the numbers could be negotiated so that this approach would result in no gain, no loss to the universities, I would hope that from the beginning of developing and negotiating the approach a serious attempt would be made to make the rent cover *fully* the cost of space. If this occurred, the universities would have a way of solving their new and renovated space needs that would be far superior to the "pork barrel" end runs and to special federal programs of grants for buildings and renovation. It would automatically adjust the support for space to the amount of federally sponsored work. Since the latter is peer reviewed and less politically noisy than grants for buildings, the whole process of research support would be a little more effective and less controversial. To the extent that it helped remove pooled costs from a worry on Capitol Hill, everyone would benefit.

Issues

There are many questions to be studied and issues to be resolved before one could make this approach into a firm prescription. Clearly, both universities and government would calculate carefully whether they would become "better off." But the proposal could be firmed in such a way that on average *neither* had an economic advantage. The object is to make the whole interaction an arena of less controversy, better understood and defended, and to return to the flavor of partnership.

Some of the questions are: 1) Would cost-sharing still be required? 2) What differences (if any) should there be between public and private institutions? 3) Could the idea of rent be extended to research equipment use? 4) Should rent-per-square-foot be a constant in each geographical area? for each type (college, research university, off-campus laboratory) of institution? 5) Should a *third* category of space (in addition to laboratory and office space) be created for computerized offices or dry laboratories? 6) Would a university immediately have a surplus of space, and how much inefficiency would accompany empty space and moving stimulated by a principal investigator's desire to minimize the pooled costs charged to him? 7) Would universities in fact hold P.I.'s financially responsible for space, or would they average in some way? 8) What are realistic assumptions about the accounting expense associated with calculating rent? How often would it be necessary to revise the figure? 9) When the whole system was put together, would the incentives be correct? 10) How would it interact with initiatives in other areas, such as effort reporting and longevity of grants, not addressed here?

DRAFT of July 8 1985

RLS/DIP:jeb

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ACADEMIC RESEARCH FACILITIES:
Financing Strategies and Evaluation Procedures

July 22 - 23, 1985

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THE GOVERNMENT-UNIVERSITY-INDUSTRY RESEARCH ROUNDTABLE

The Research Roundtable, sponsored by the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, was created to foster strong American science through effective working relationships among government, universities, and industry.

Purpose

The Government-University-Industry Research Roundtable was created to provide a forum where scientists, engineers, administrators, and policy makers from government, universities, and industry can come together on an ongoing basis to explore ways to improve the productivity of the nation's research enterprise. The object is to try to understand issues, to inject imaginative thought into the system, and to provide a setting for seeking common ground. The Roundtable will not make recommendations, nor offer specific advice. It will develop options and bring all interested parties together. The uniqueness of the Roundtable is in the breadth of its membership and in the continuity with which it can address issues.

Founding

The Roundtable was established in 1984 in response to recommendations from the National Commission on Research and the National Academy of Sciences (NAS) *Ad Hoc* Committee on Government-University Relations in Support of Science. Initially created under the auspices of the NAS, the Roundtable now also functions under the sponsorship of the National Academy of Engineering and of the Institute of Medicine.

Mode of Operation

The Roundtable is guided by a twenty-member Council which sets the Roundtable agenda and oversees the plans and activities of the working groups. In addition to this role, the Council will, from time to time, address topics directly.

Four working groups have been formed. Each has a chairman and vice-chairman from the Council. Other working group members have been recruited wherever the most appropriate people for the topics at hand could be found. In addition to the core members, each group involves auxiliary individuals and organizations in its activities.

Roundtable Publications*

WORKING GROUP BACKGROUND PAPERS
Papers describing the range of issues relevant to each of three working groups:

Working Group One – "The Identification, Recruitment, and Retention of Science and Engineering Talent," *Discussion of Issues and Approaches* (September 19, 1984)

Working Group Two – "Capacity of Academic Science and Engineering: Institutional Renewal," *Discussion of Issues and Approaches* (August 30, 1984)

Working Group Three – "New Alliances and Partnerships: Enhancing the Utilization of Scientific and Engineering Advances," *Discussion of Issues and Approaches* (October 2, 1984)

REPORTS ON AND BACKGROUND MATERIALS FOR ROUNDTABLE EVENTS

Reducing Bureaucratic Accretion in Government and University Procedures for Sponsored Research: New Approaches in Process and Additional Areas for Attention – Proceedings of a hearing held June 5, 1985 (full report and summary)

Academic Research Facilities: Financing Strategies and Evaluation Procedures – Background materials for a conference held July 22-23, 1985 (report forthcoming)

New Alliances and Partnerships in American Science and Engineering – Background materials for a conference held December 5, 1985 (report forthcoming)

TESTIMONY

Dale Corson, before the Senate Subcommittee on Science, Technology and Space, April 1985, for a hearing on technology and industrial competitiveness

Dale Corson, before the House Science and Technology Committee Task Force on Science Policy, May 1985, for a hearing on "The Federal Government and the University Research Infrastructure"

Robert Sproull, before the House Science and Technology Committee Task Force on Science Policy, June 1985, for a hearing on "Science and the Political Process"

Don Phillips, before the House Subcommittee on Science, Research and Technology, October 1985, for a hearing on "H.R. 2823, The University Research Facilities Revitalization Act of 1985"

OTHER PUBLICATIONS

Federal Funding of Scientific Facilities – A discussion of the issues arising from direct congressional funding of facilities (February 2, 1985)

Government-University-Industry Research Roundtable Annual Report for 1985

*All publications available free of charge by calling or writing the Roundtable.

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The Working Groups

"Talent"

WORKING GROUP ONE – "The Identification, Recruitment, and Retention of Science and Engineering Talent"

Scope: The conditions and strategies that will draw excellence from all segments of the population into science and engineering on an ongoing basis and that will enhance the attractiveness of academic careers.

"Institutional Renewal"

WORKING GROUP TWO – "Capacity of Academic Science and Engineering: Institutional Renewal"

Scope: The organizational arrangements bearing on the research enterprise as well as the support mechanisms and physical facilities.

"New Alliances"

WORKING GROUP THREE – "New Alliances and Partnerships: Enhancing the Utilization of Scientific and Engineering Advances"

Scope: The joint ventures and emerging relationships among universities and between universities, small and large companies, the financial community, state governments, and federal laboratories.

"Major Issues"

WORKING GROUP FOUR – "Major Institutional Issues Involving the Relationship Between Science, Technology, and Society"

Scope: Broad and longer range matters underlying the whole research system. The group has two foci: first, an international comparison of research policies and strategies; second, the changing roles of R&D performers.

Each group has a general area of jurisdiction within which it selects particular topics for examination. As topics are studied, the working groups elucidate issues, identify problems and opportunities, and consider options for dealing with them. Topics are examined through options papers, policy analyses, workshops, and any other techniques thought potentially profitable. Both near- and long-term goals are pursued. The nature of the topics examined by each group vary, and groups therefore proceed at different rates and use different approaches.

As progress in understanding a particular issue is made, the results are brought before the Council for its deliberation. When an area of concern is believed ready for public discussion, some means – hearing, conference, publication, and other mechanisms – of stimulating discussion among all the interested constituencies is devised.

Guided by the results of these events, the working groups continue to pursue the topic. This might involve the demonstration of new operational procedures in the research system, further study of selected subjects, and interaction with additional relevant constituencies.

Additionally, the Roundtable establishes communication and working relationships with many associations, scientific societies, executive agencies, congressional offices, industry representatives, and states.

Funding

Funds for initiation and early operation of the Roundtable were provided by the National Research Council Fund and the Sloan and Mellon Foundations. Support for long-term operation is being sought from a variety of sources including industry and government.

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Working Group Four convenes experts to work on specific issues; it does not have a fixed membership.